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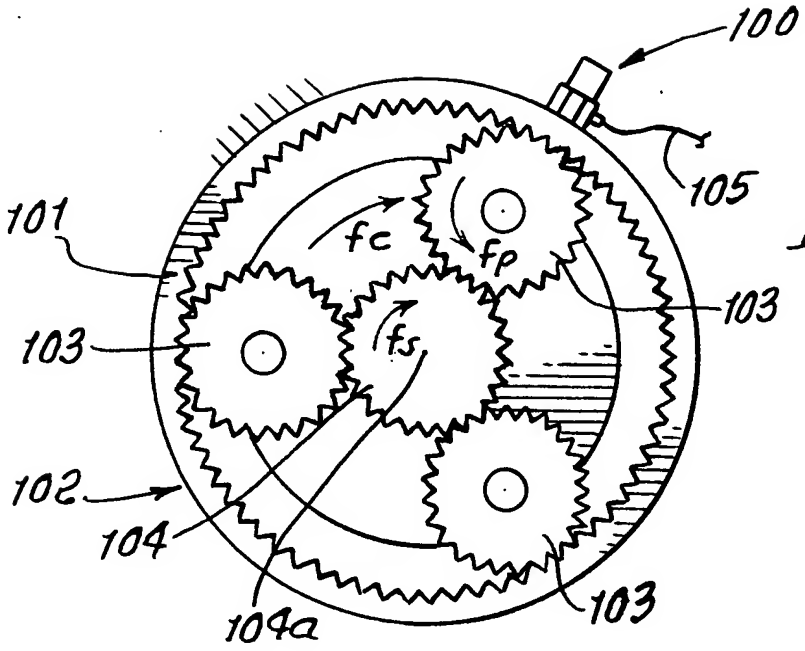
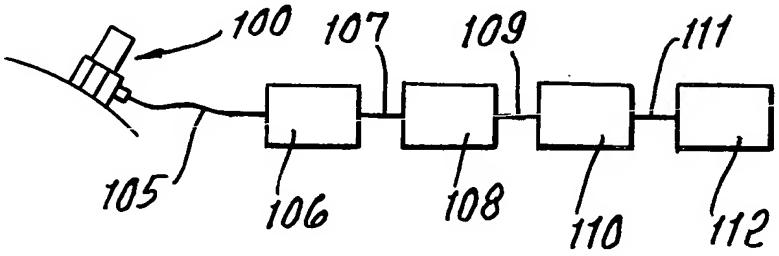


FIG. 1.1

FIG. 3.1



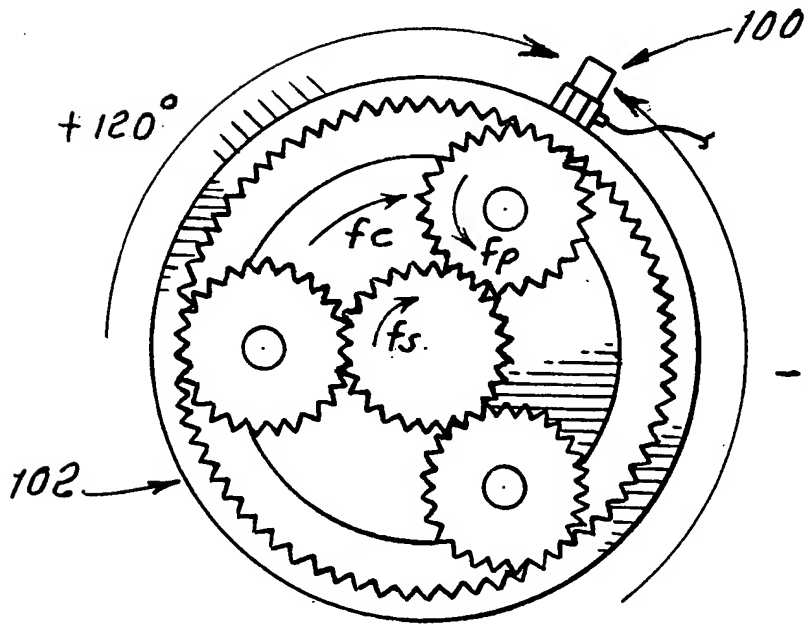
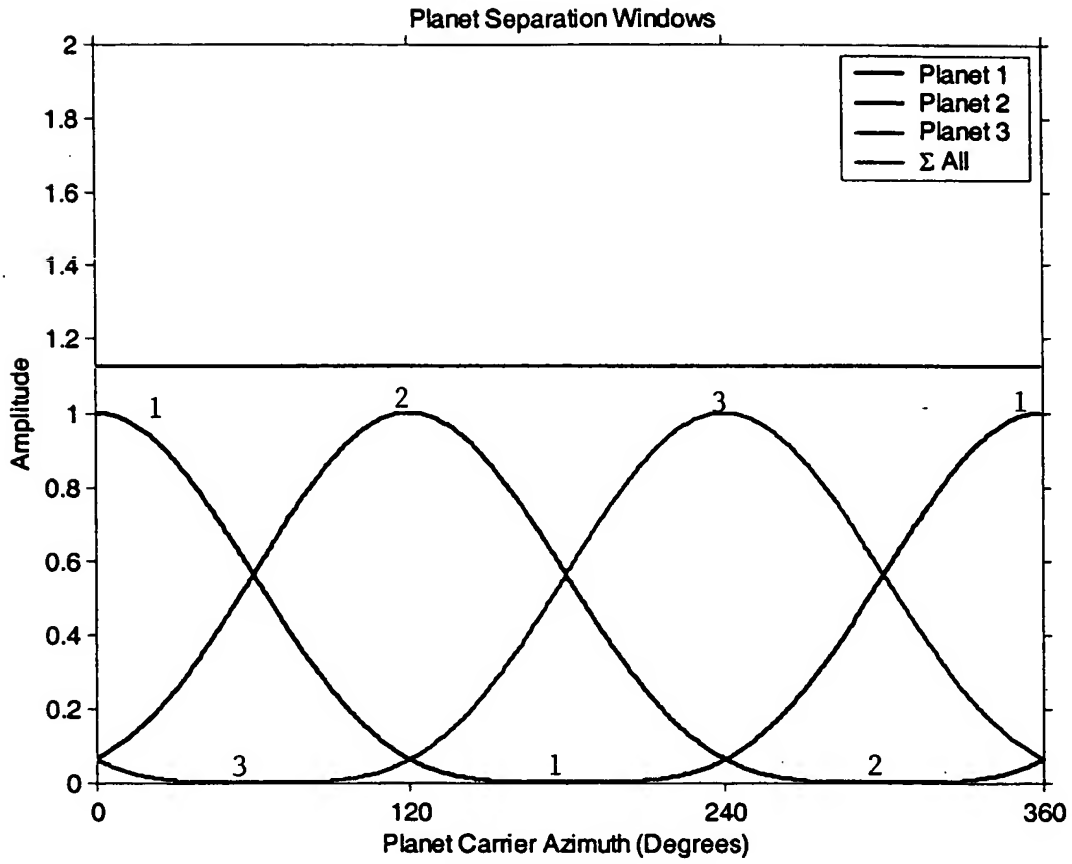


FIG. 2.1

FIG. 1.2a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Planet 2
Planet 3
Σ All
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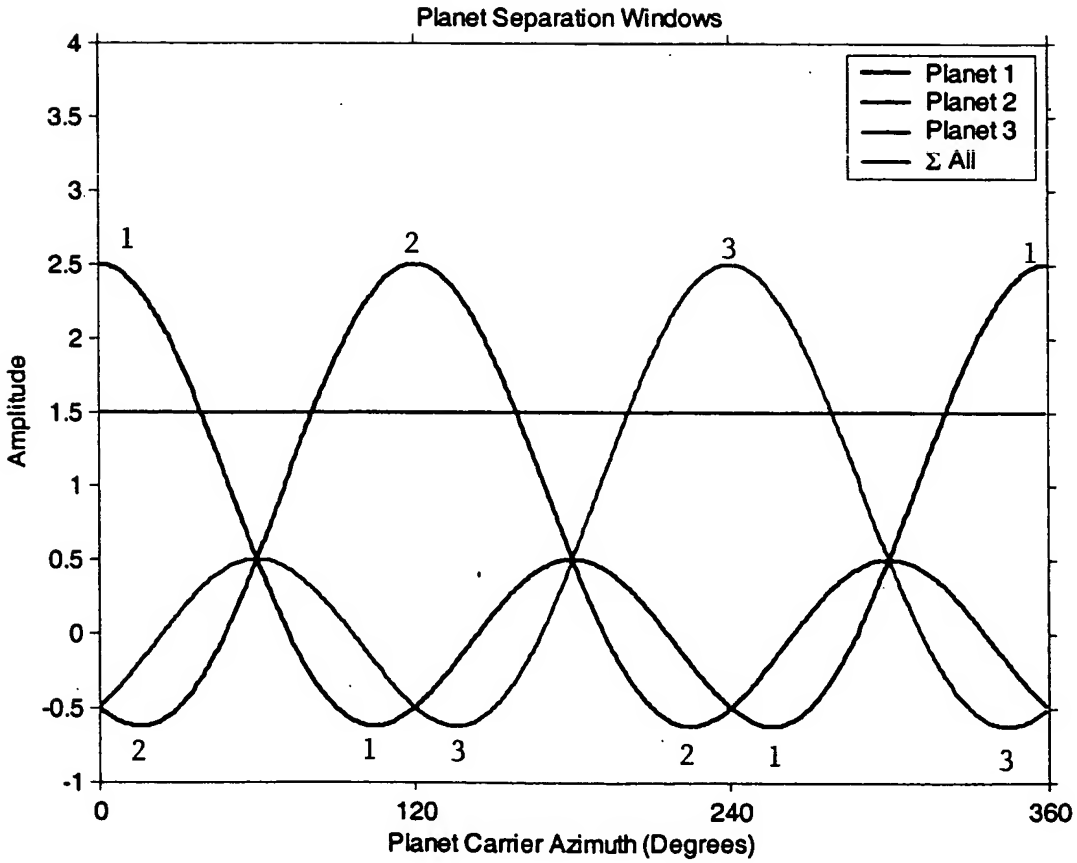
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1
2
3
1
3
1
2
0
120
240
360
Planet Carrier Azimuth (Degrees)

FIG. 1.2b


Planet Separation Windows
Planet 1
Planet 2
Planet 3
Σ All
Amplitude
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3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
0
120
240
360
Planet Carrier Azimuth (Degrees)
1
2
3
1
2
1
3
2
1
3

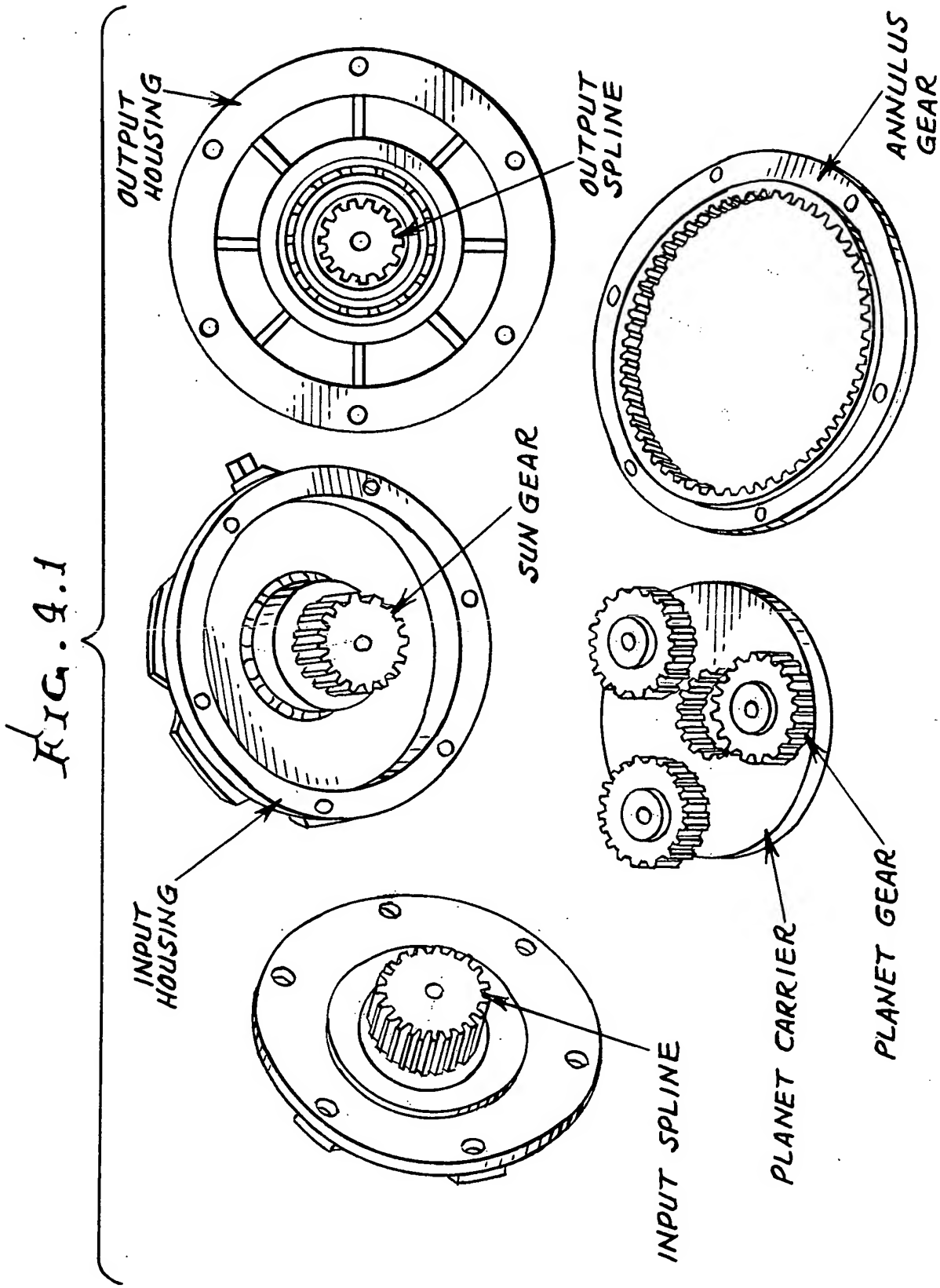

OUTPUT HOUSING
OUTPUT SPLINE
ANNULUS GEAR
SUN GEAR
INPUT HOUSING
INPUT SPLINE
PLANET CARRIER
PLANET GEAR

FIG. 4.1

Sun gear separations (window = $w_{power}(t)$) – no fault.

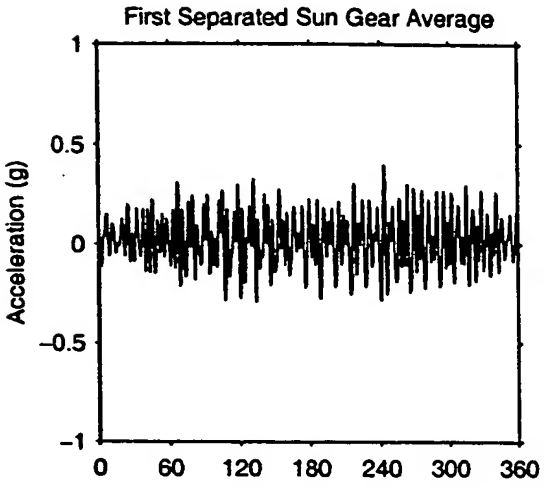


FIG. 4.2a

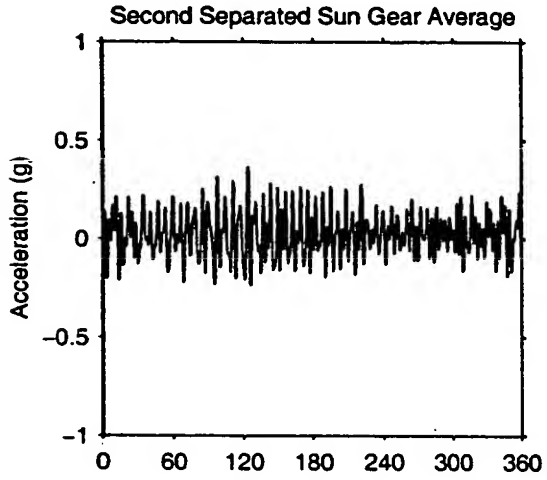


FIG. 4.2b

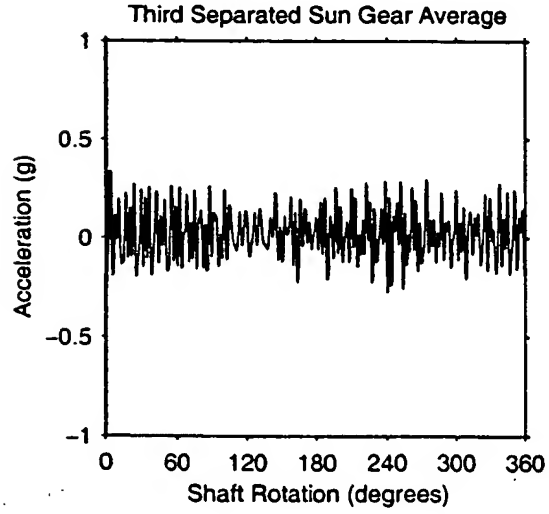


FIG. 4.2c

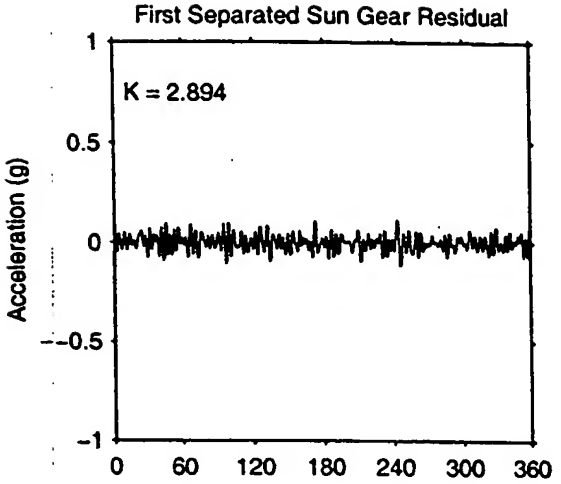


FIG. 4.2d

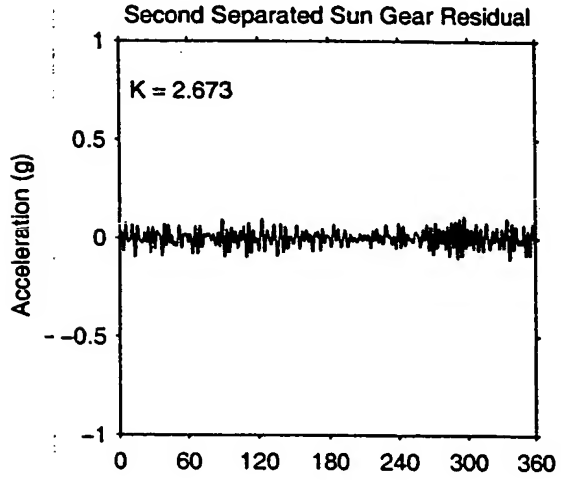


FIG. 4.2e

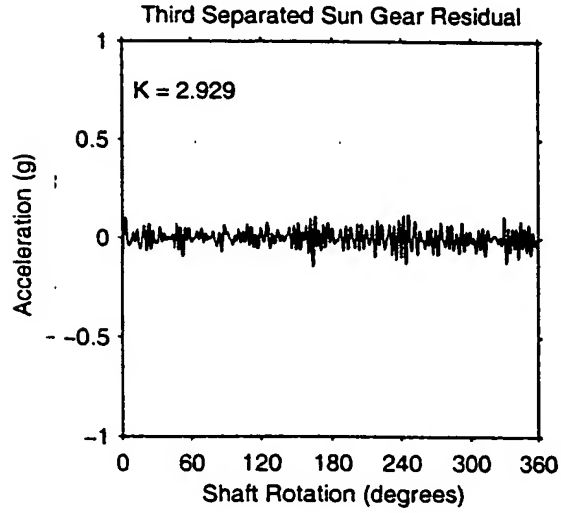


FIG. 4.2f

Sun gear separations (window = $w_{sum}(t)$) – no fault.

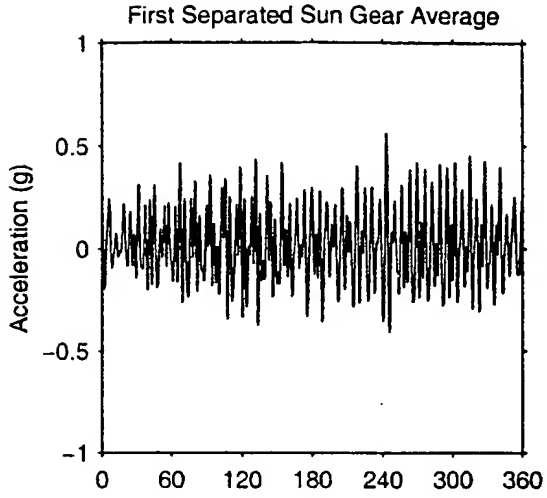


FIG. 4.3a

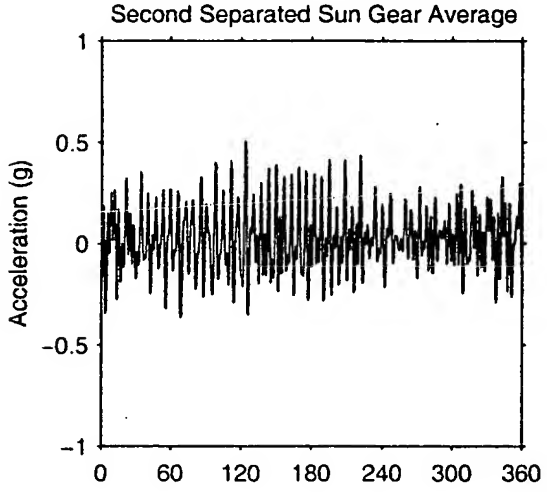


FIG. 4.3b

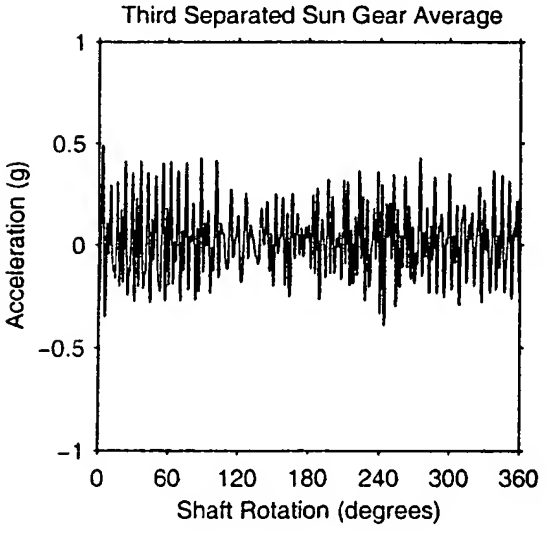


FIG. 4.3c

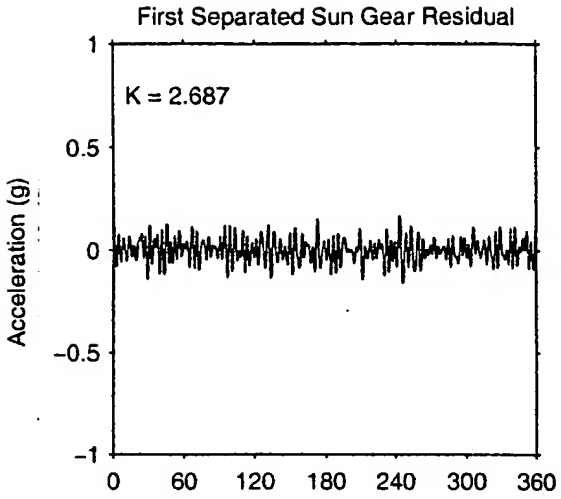


FIG. 4.3d

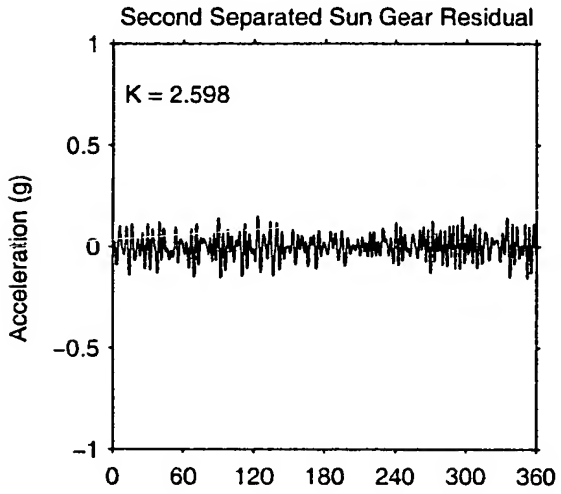


FIG. 4.3e

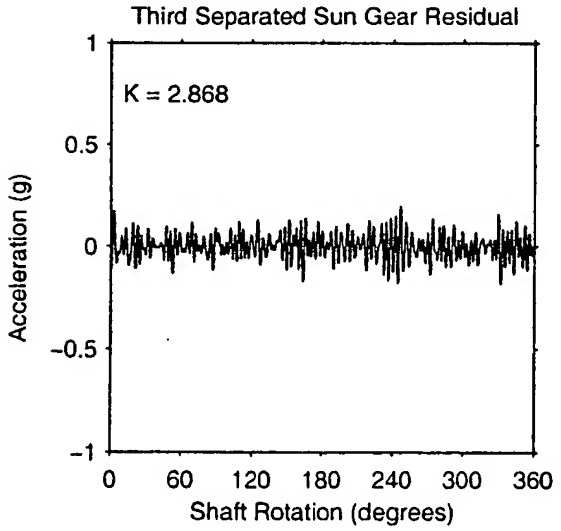


FIG. 4.3f

Ordinary, combined & modified sun gear averages (window = $w_{power}(t)$) – no fault.

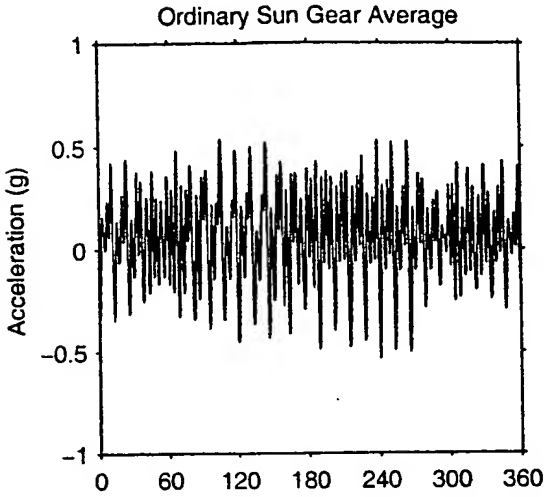


FIG. 4.4a

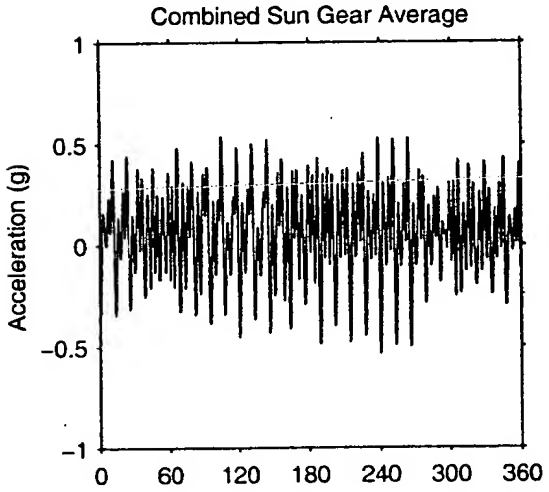


FIG. 4.4b

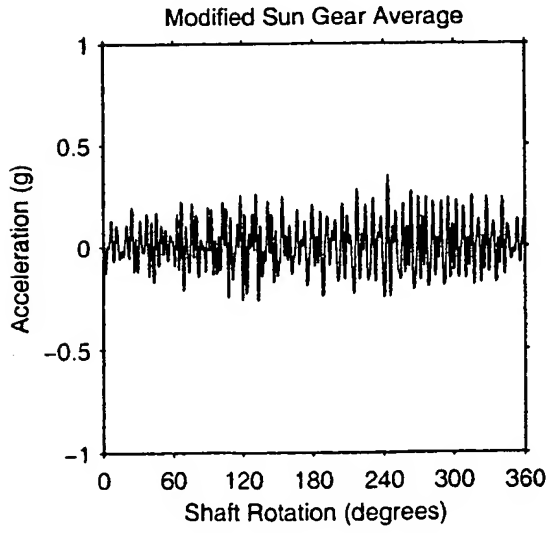


FIG. 4.4c

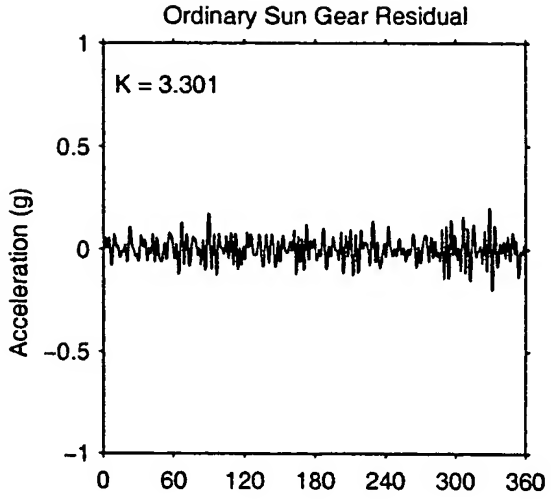


FIG. 4.4d

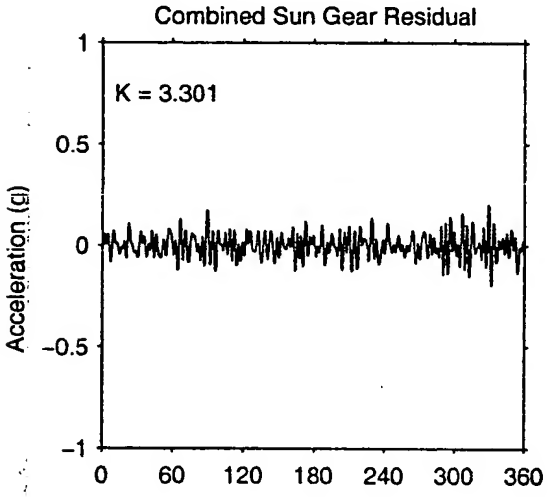


FIG. 4.4e

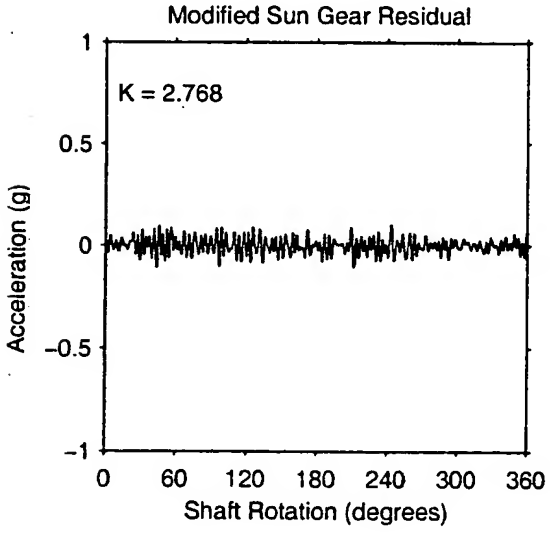


FIG. 4.4f

Ordinary, combined & modified sun gear averages (window = $w_{Sun}(t)$) – no fault.

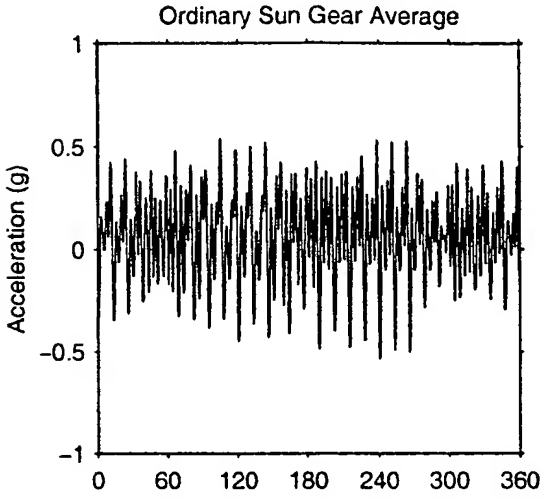


FIG. 4.5a

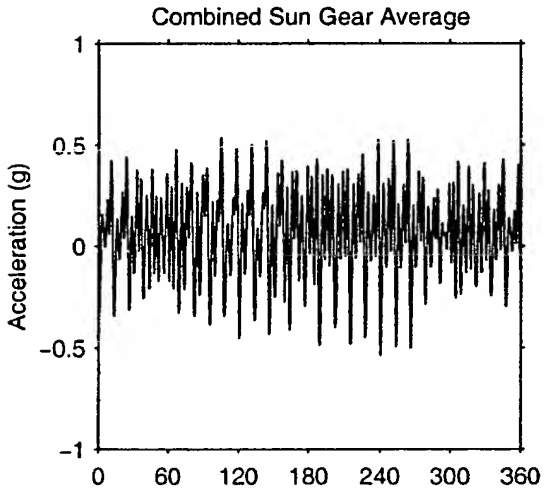


FIG. 4.5b

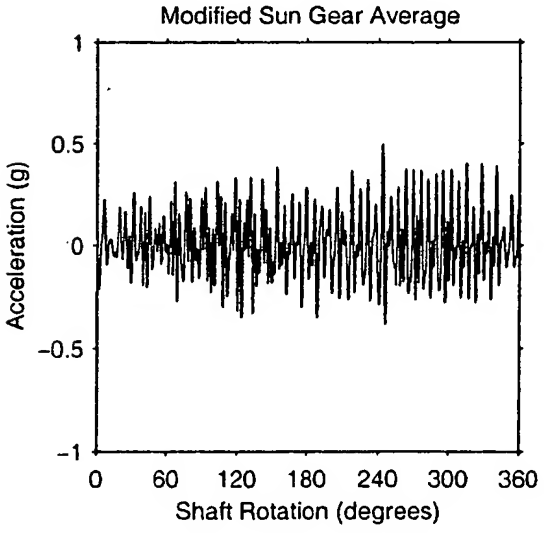


FIG. 4.5c

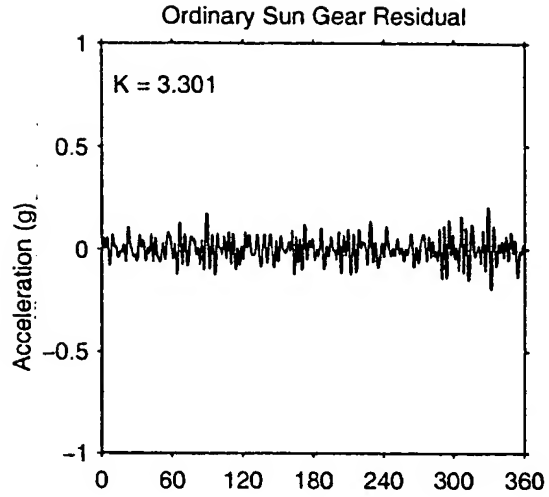


FIG. 4.5d

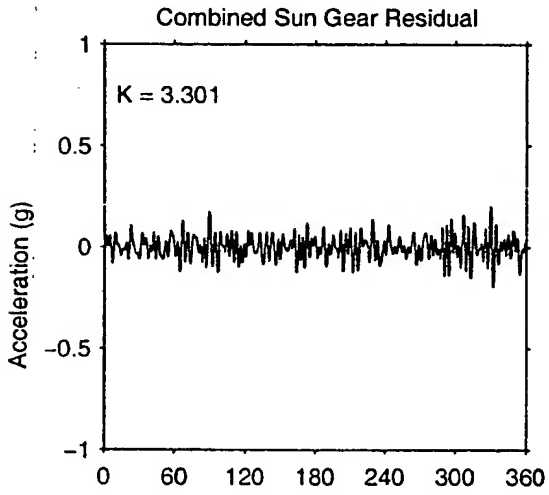


FIG. 4.5e

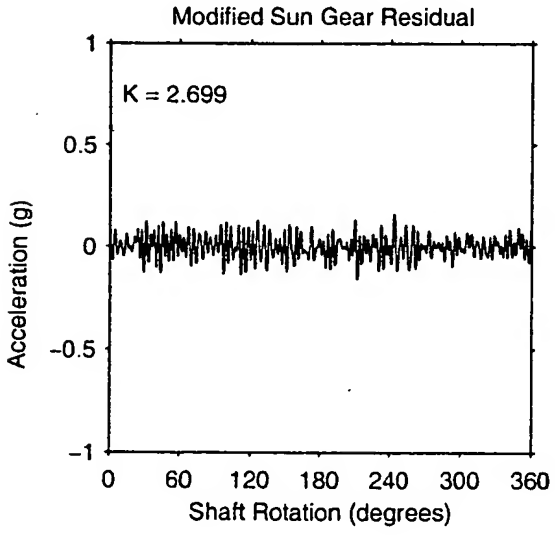


FIG. 4.5f

Sun gear separations (window = $w_{power}(t)$) – fault.

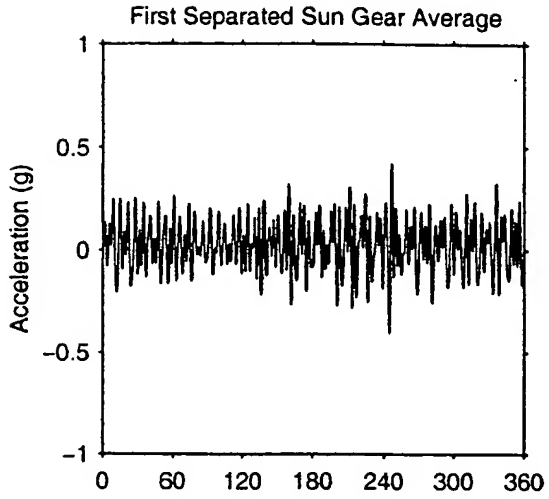


FIG. 4.6a

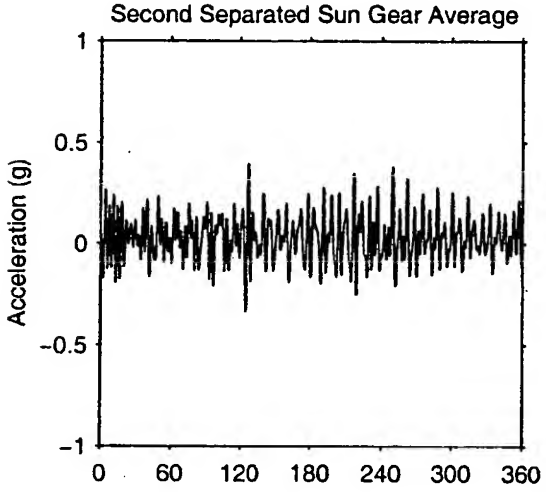


FIG. 4.6b

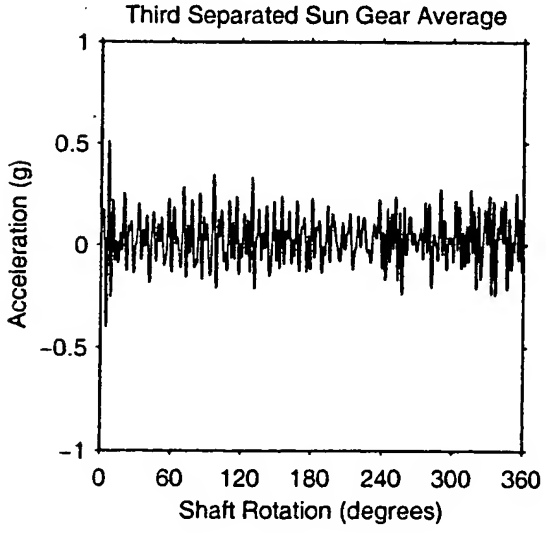


FIG. 4.6c

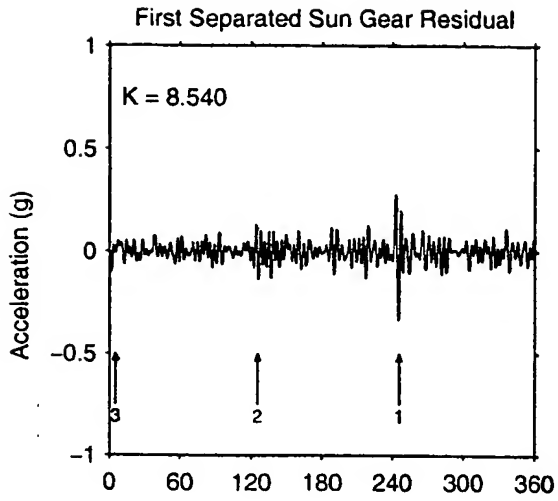


FIG. 4.6d

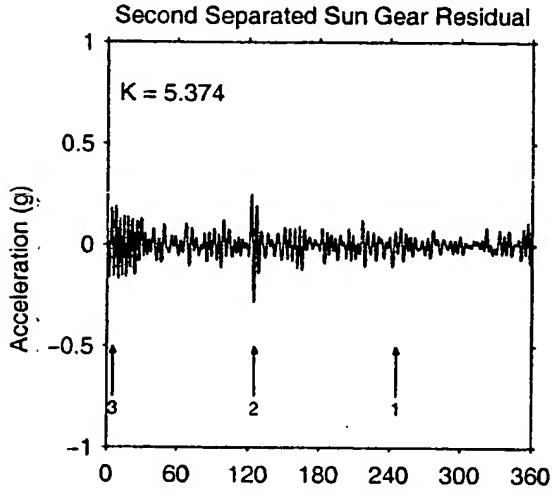


FIG. 4.6e

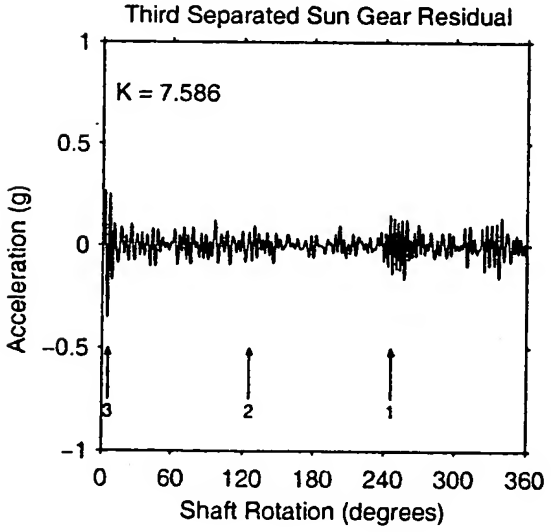


FIG. 4.6f

Sun gear separations (window = $w_{sum}(t)$) – fault.

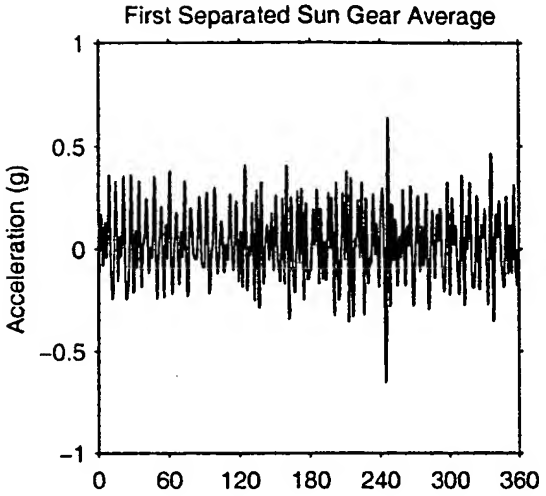


FIG. 4.7a

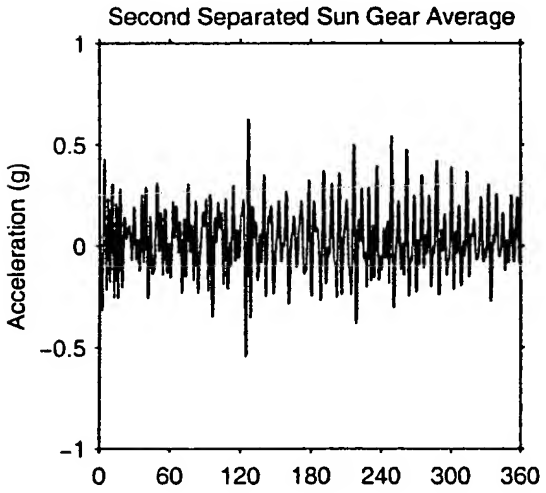


FIG. 4.7b

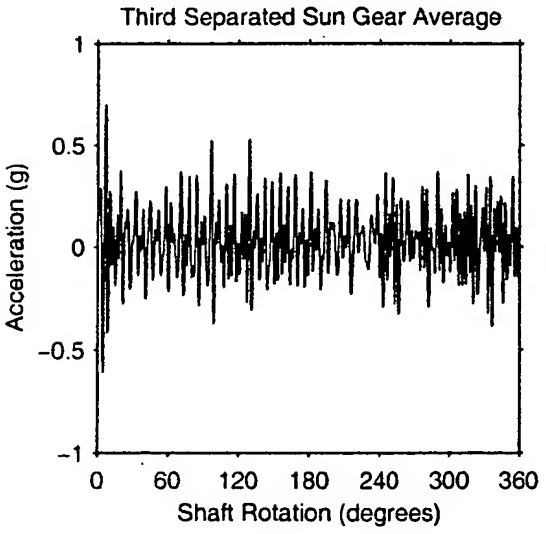


FIG. 4.7c

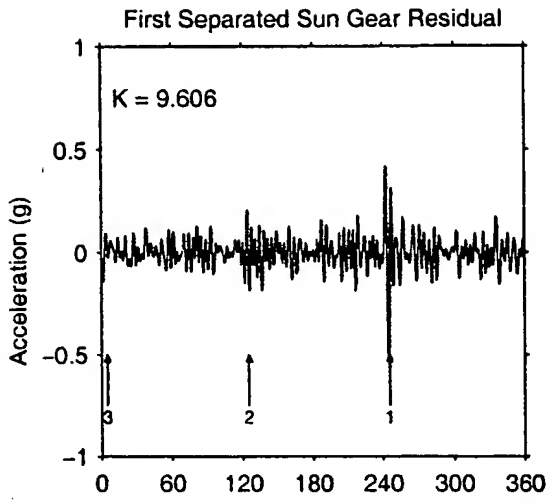


FIG. 4.7d

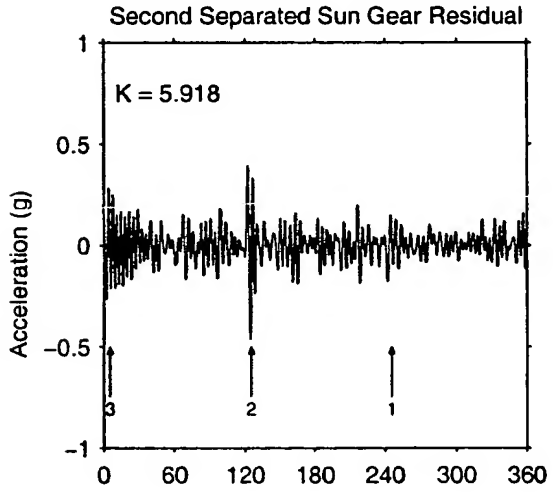


FIG. 4.7e

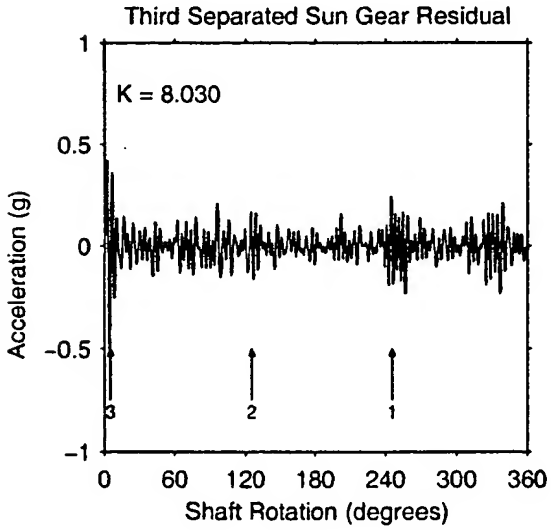


FIG. 4.7f

Ordinary, combined & modified sun gear averages (window = $w_{power}(t)$) – fault.

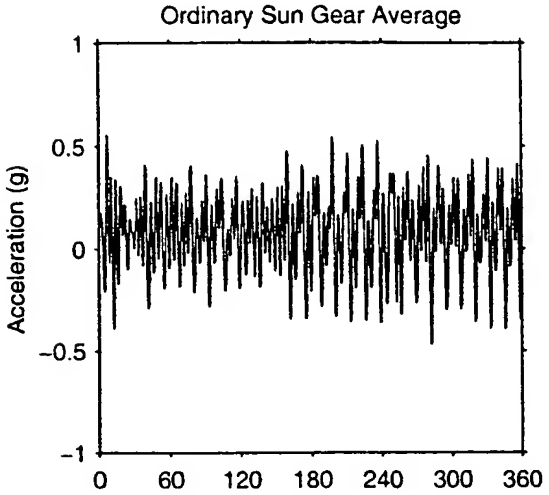


FIG. 4.8a

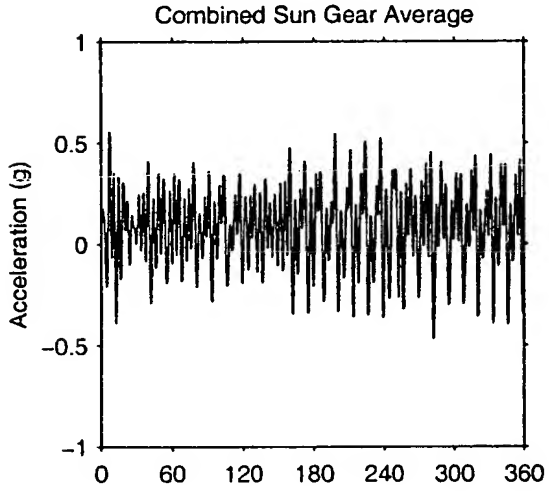


FIG. 4.8b

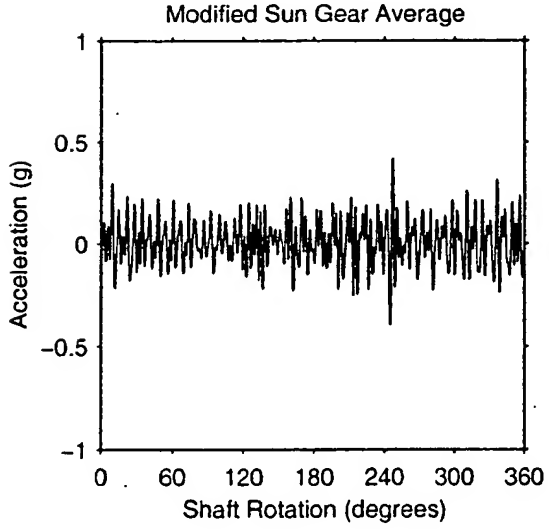


FIG. 4.8c

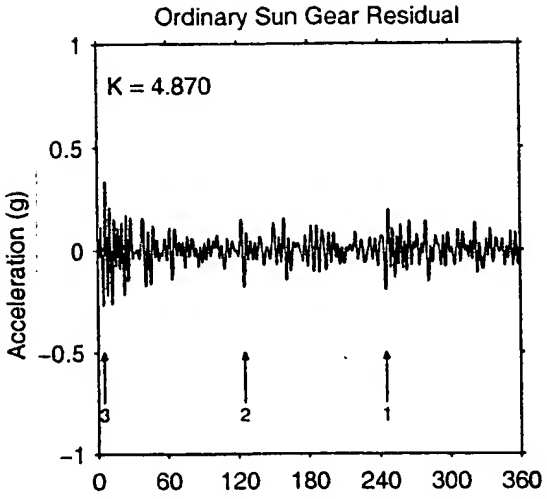


FIG. 4.8d

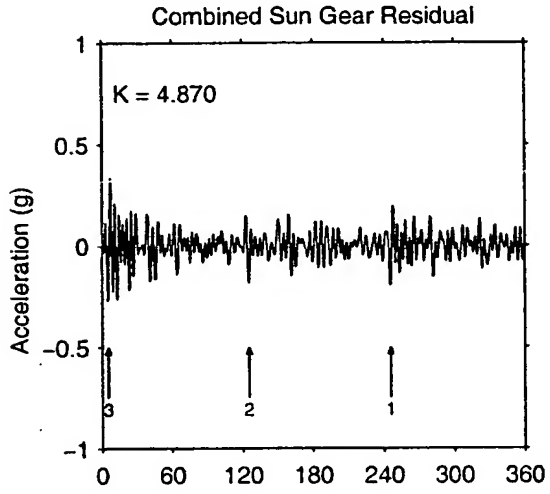


FIG. 4.8e

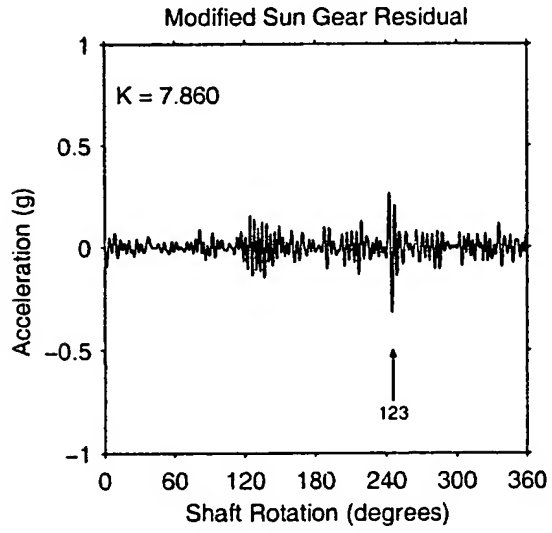


FIG. 4.8f

Ordinary, combined & modified sun gear averages (window = $w_{sum}(t)$) – fault.

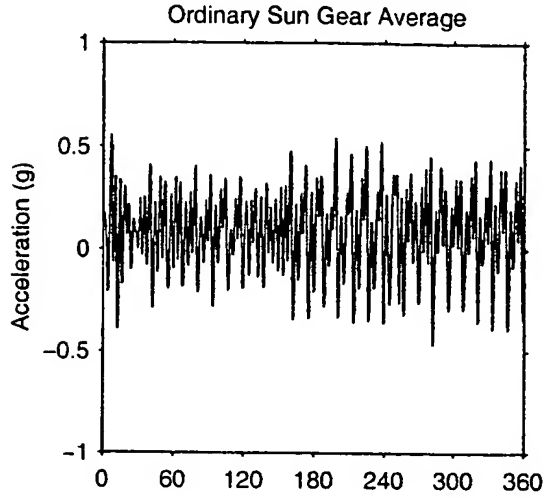


FIG. 4.9a

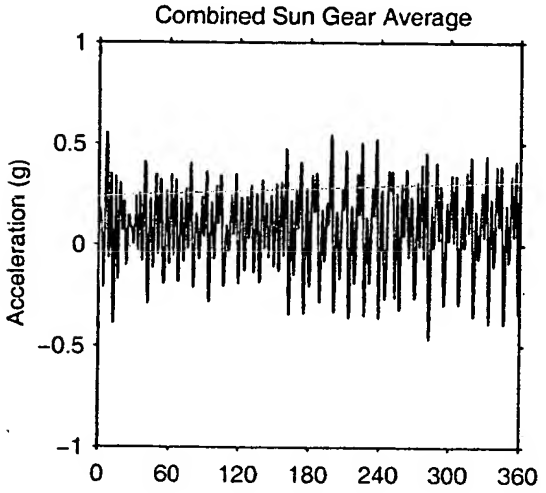


FIG. 4.9b

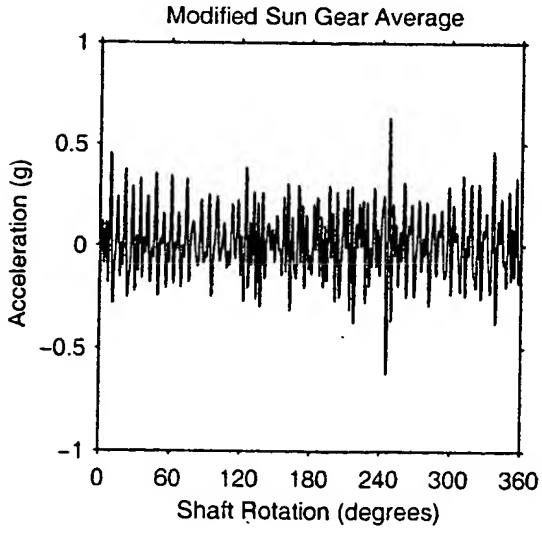


FIG. 4.9c

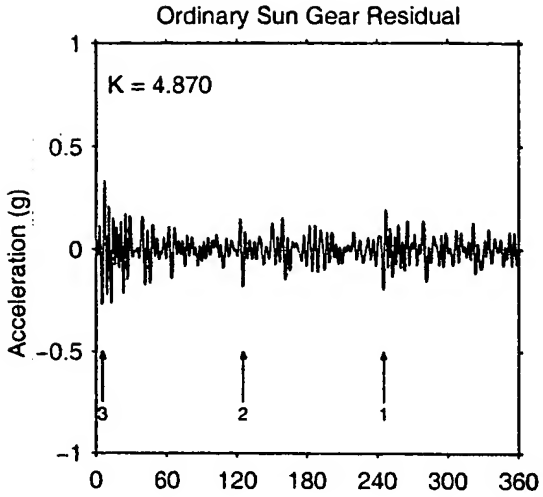


FIG. 4.9d

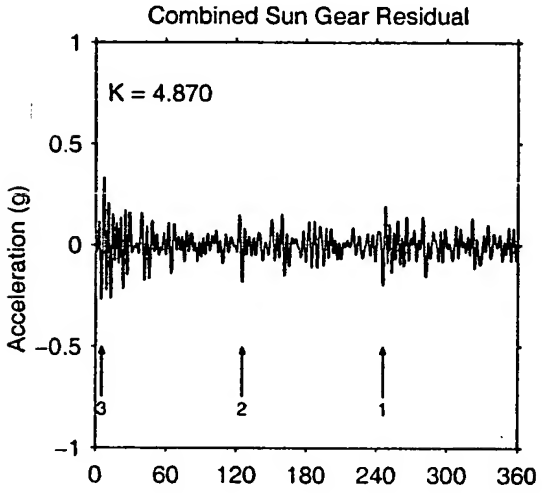


FIG. 4.9e

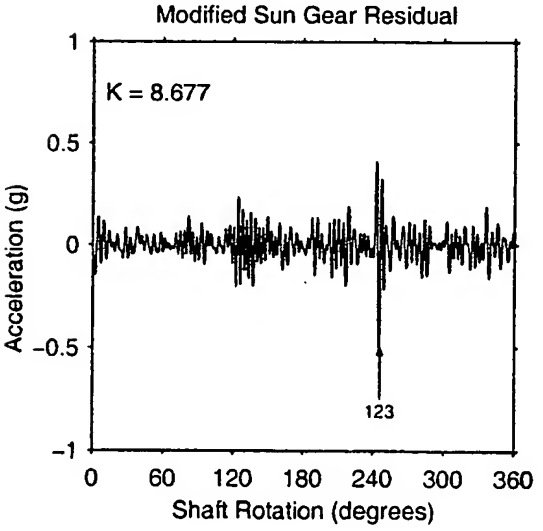


FIG. 4.9f

FIG. 4.10

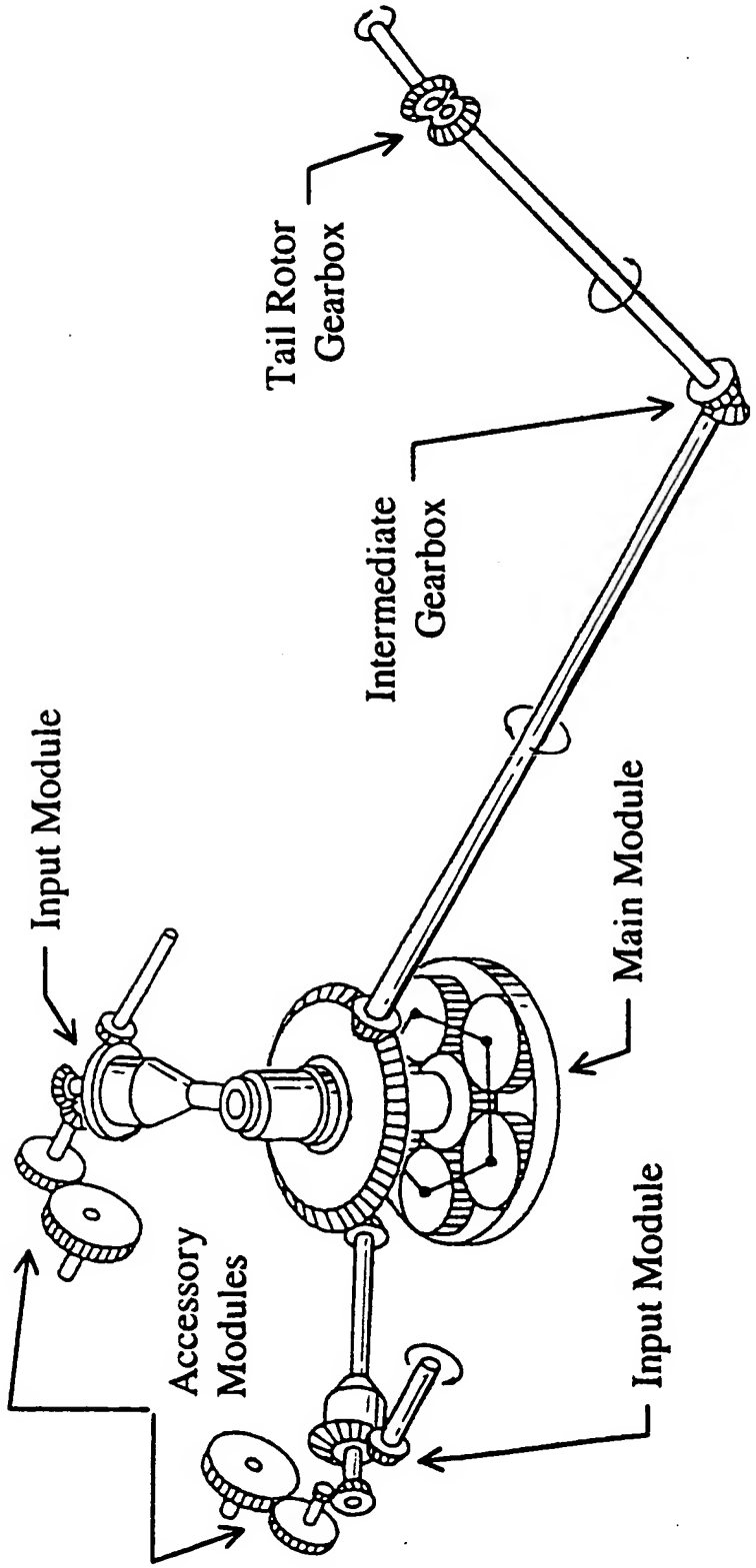

Tail Rotor Gearbox
Intermediate Gearbox
Input Module
Main Module
Accessory Modules
Input Module

FIG. 4.11

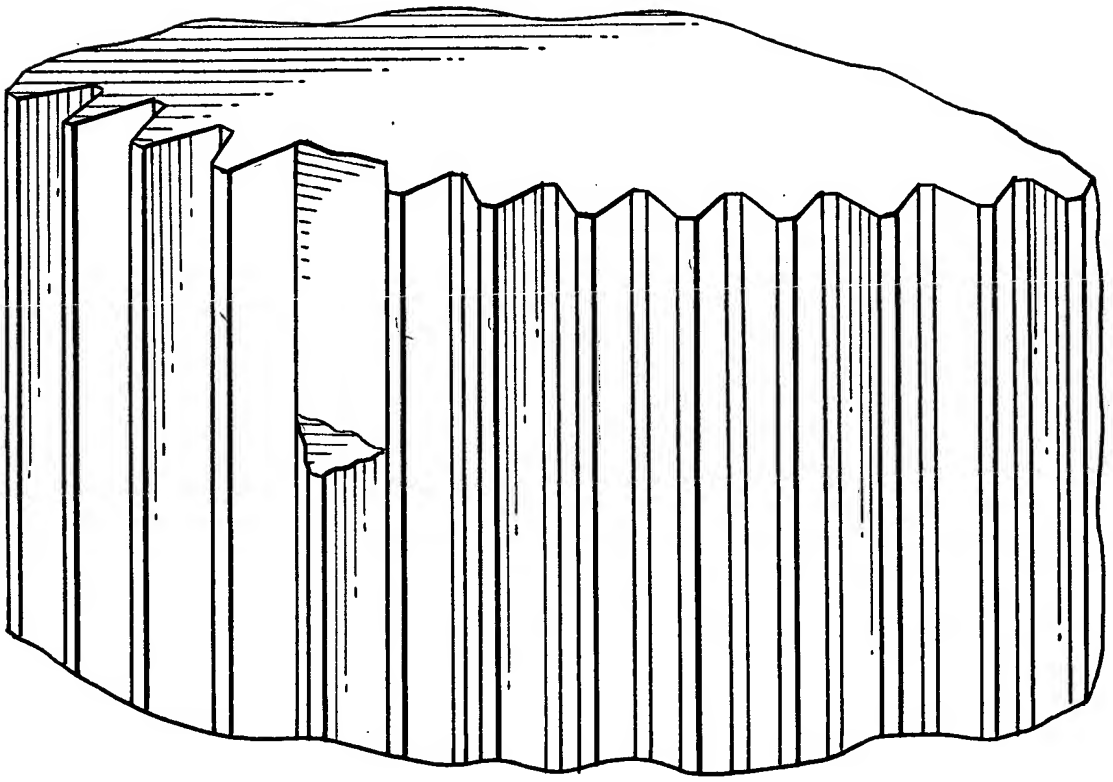


FIG. 4.12

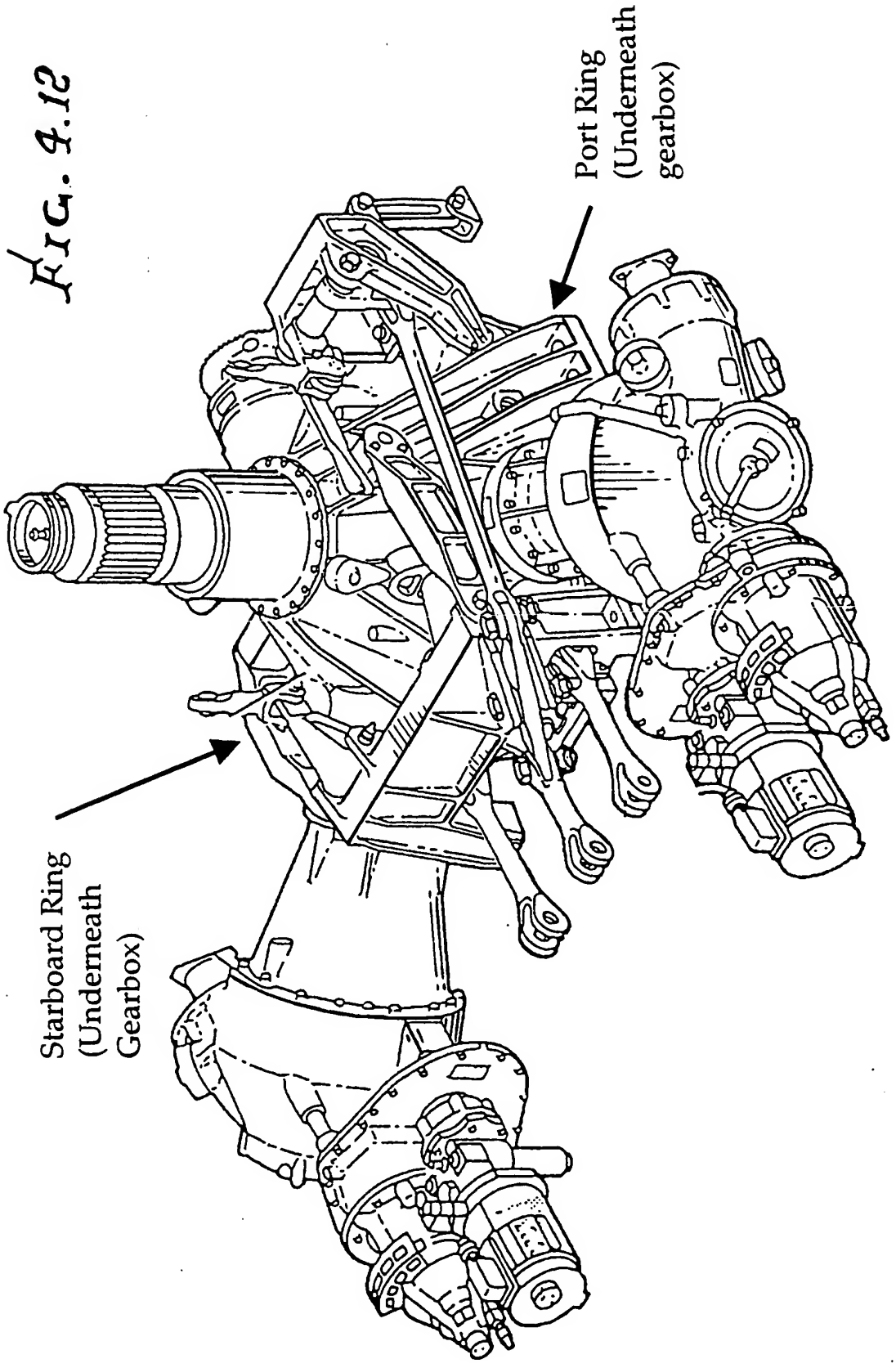

Port Ring
(Underneath
gearbox)
Starboard Ring
(Underneath
Gearbox)

FIG. 4.13a

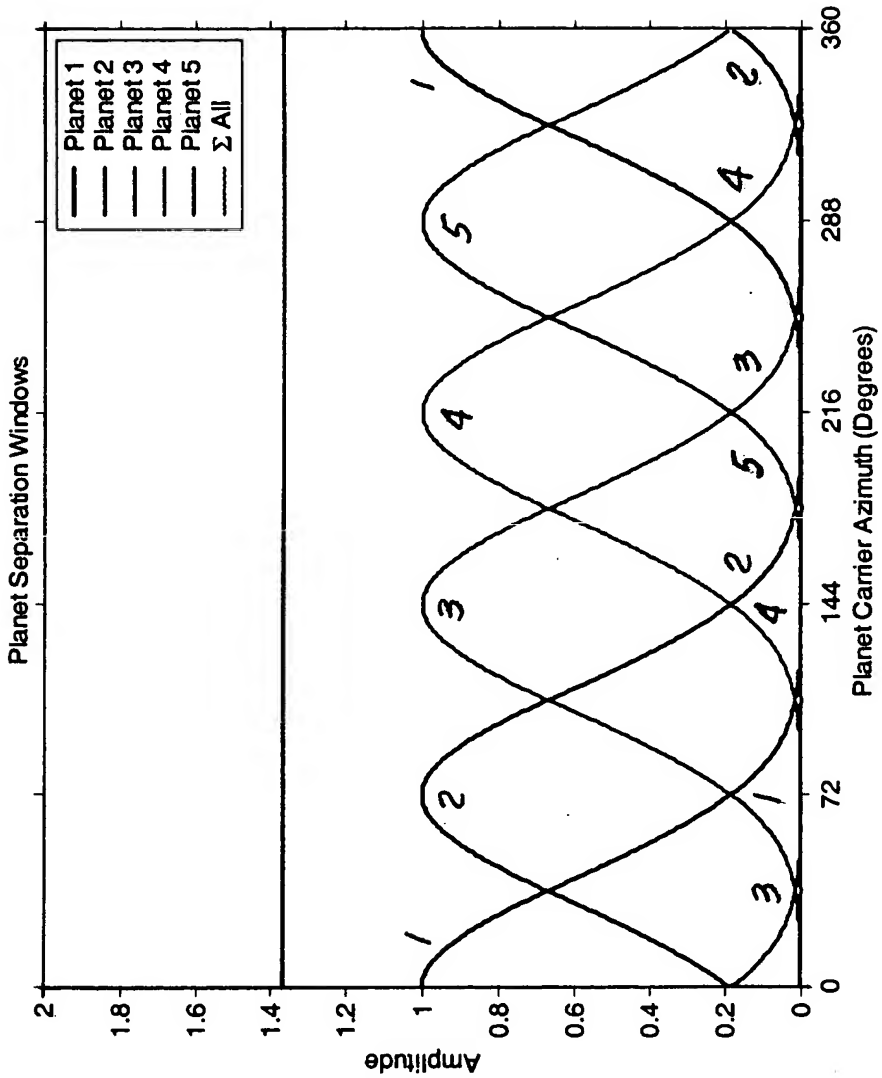

Planet Separation Windows
Planet 1
Planet 2
Planet 3
Planet 4
Planet 5
Σ All
Amplitude
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
0
72
144
216
288
360
Planet Carrier Azimuth (Degrees)

FIG. 4.13b

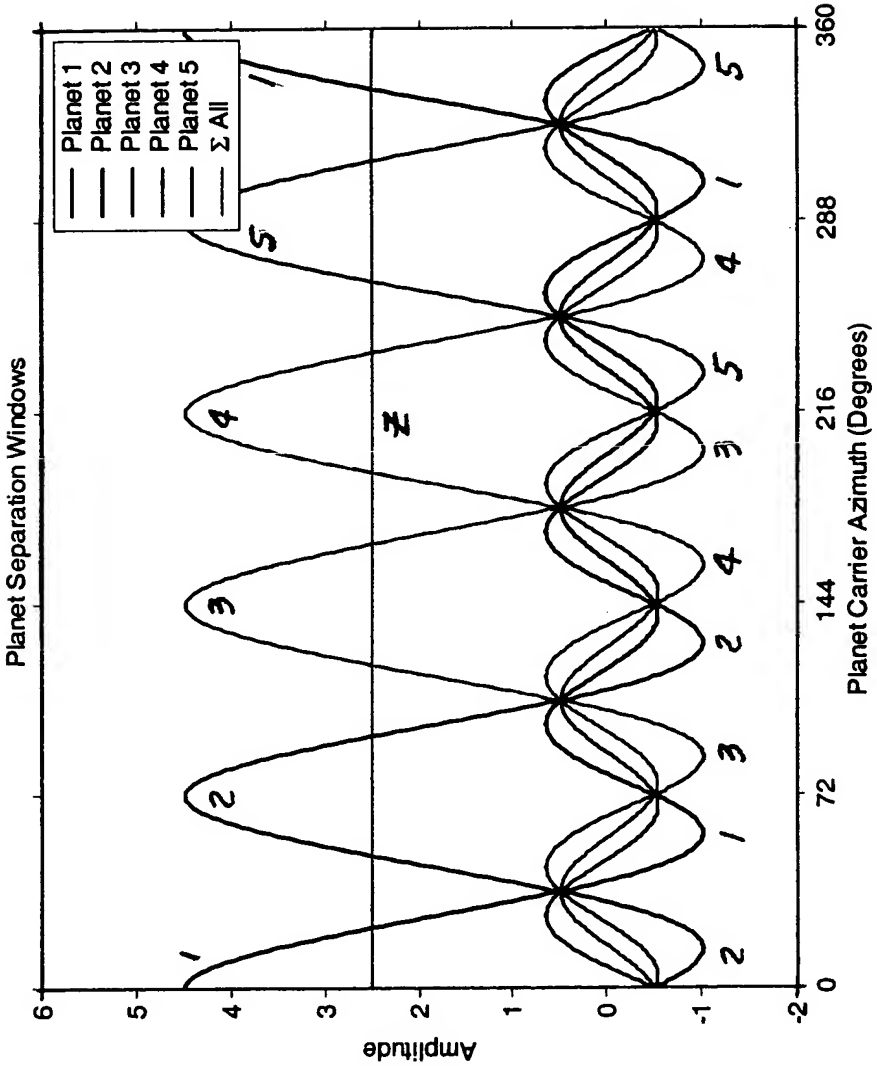

Planet Separation Windows
Planet 1
Planet 2
Planet 3
Planet 4
Planet 5
Σ All
Amplitude
6
5
4
3
2
1
0
-1
-2
0
72
144
216
288
360
Planet Carrier Azimuth (Degrees)

FIG. 4.14a

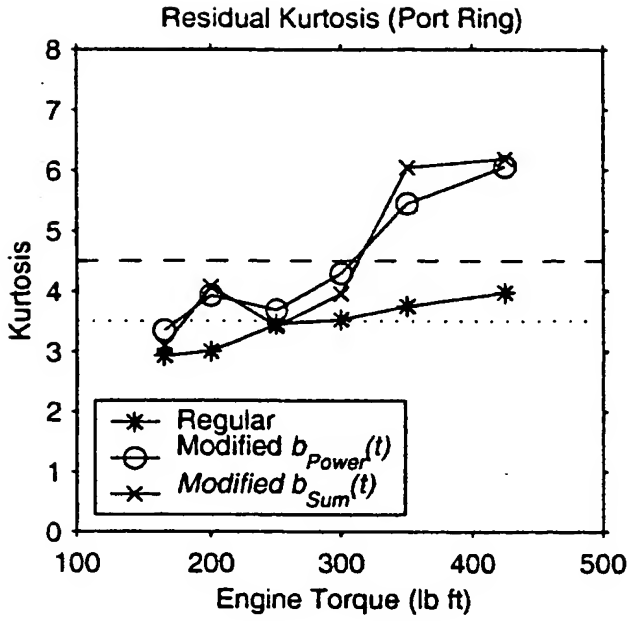
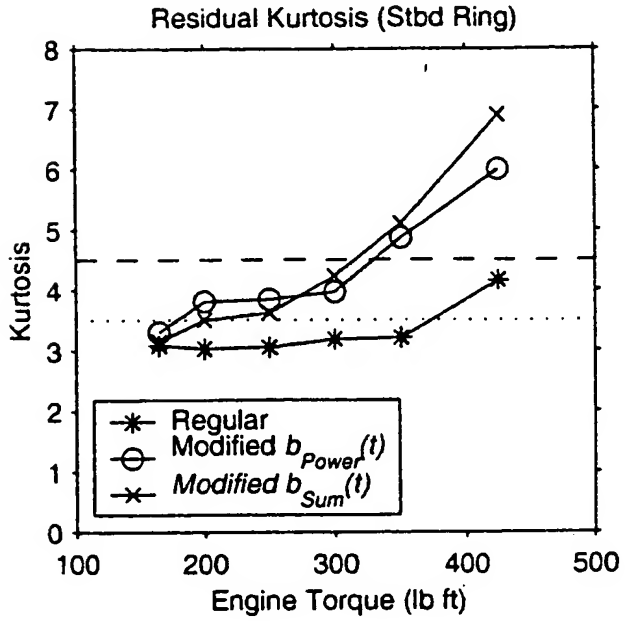


FIG. 4.14b



Spectra of sun gear averages at 350 lb ft torque showing resonance band.

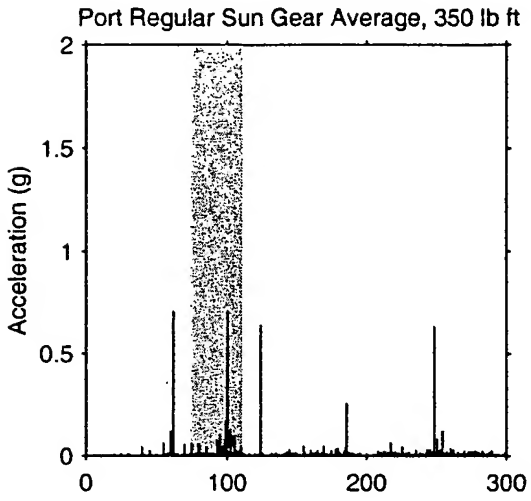


FIG. 4.15a

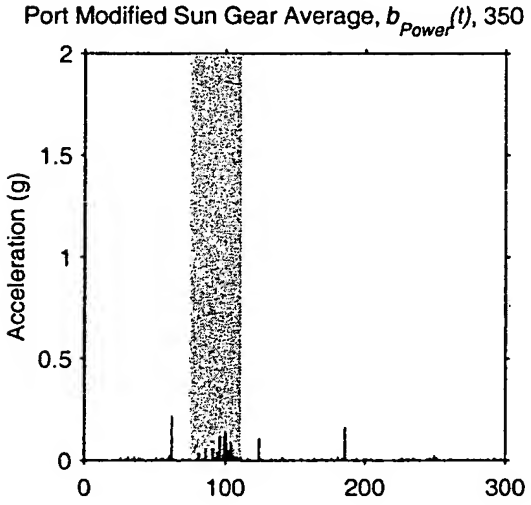


FIG. 4.15b

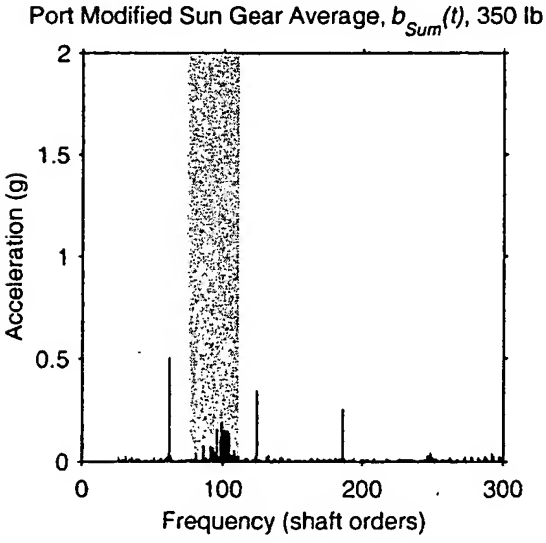


FIG. 4.15c

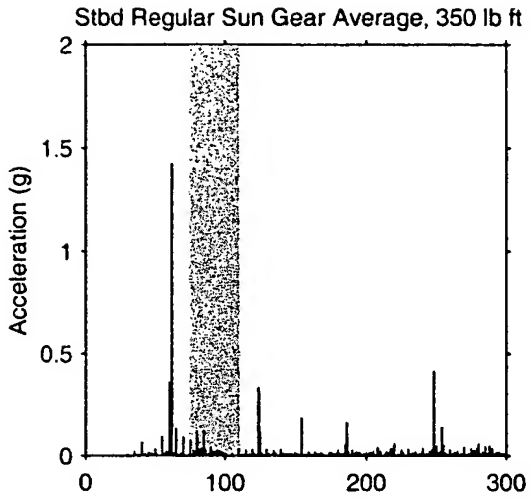


FIG. 4.15d

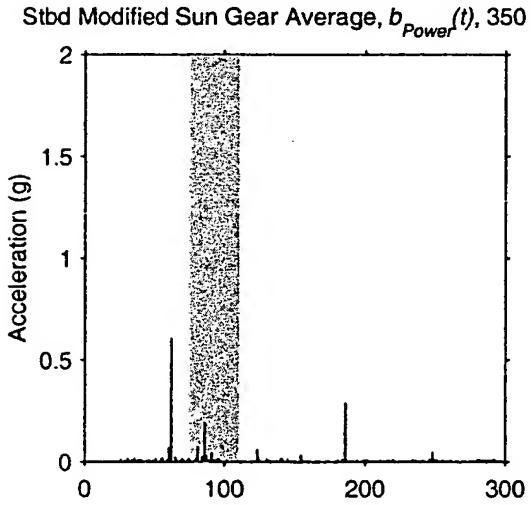


FIG. 4.15e

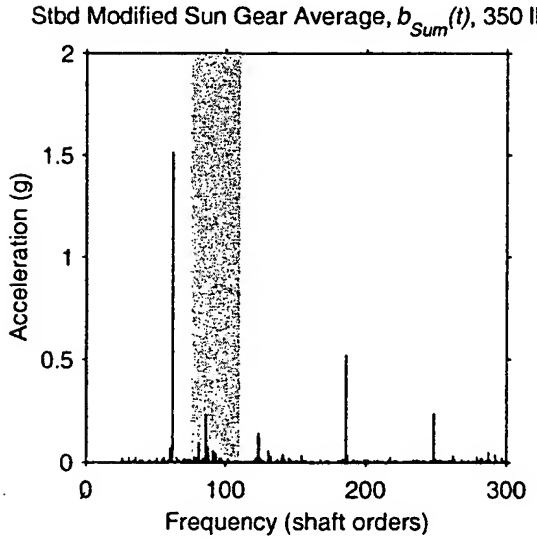


FIG. 4.15f

Sun gear averages, 425 lb ft torque, port ring accelerometer.

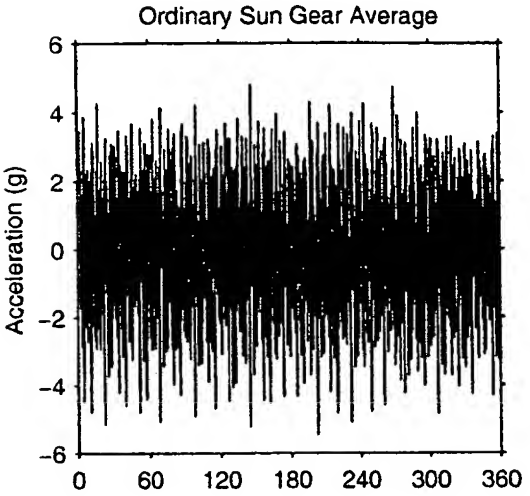


FIG. 4.16a

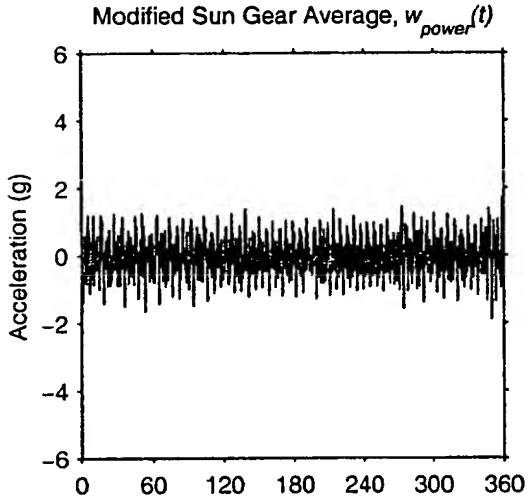


FIG. 4.16b

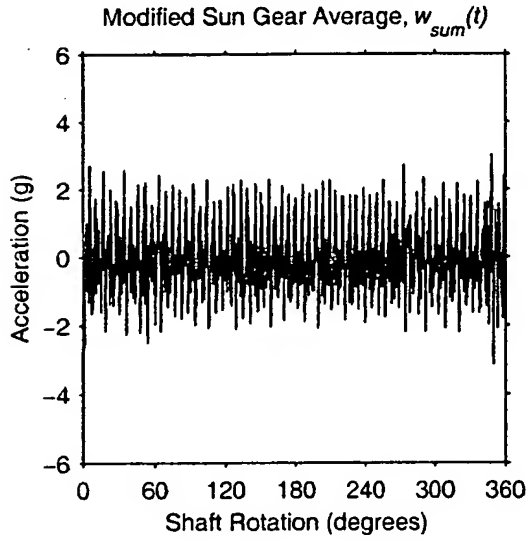


FIG. 4.16c

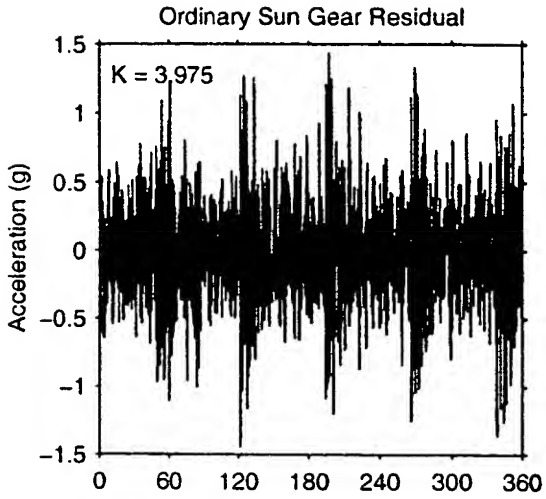


FIG. 4.16d

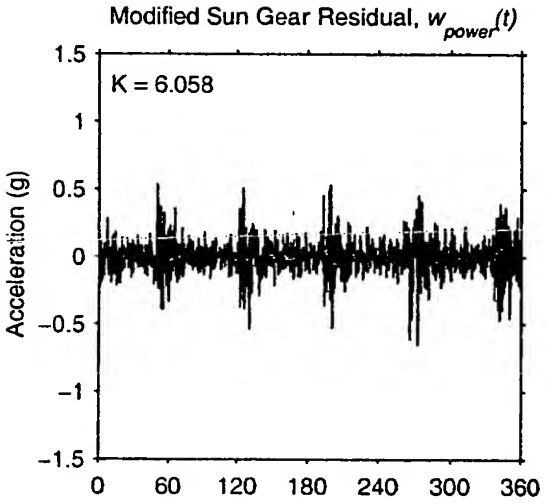


FIG. 4.16e

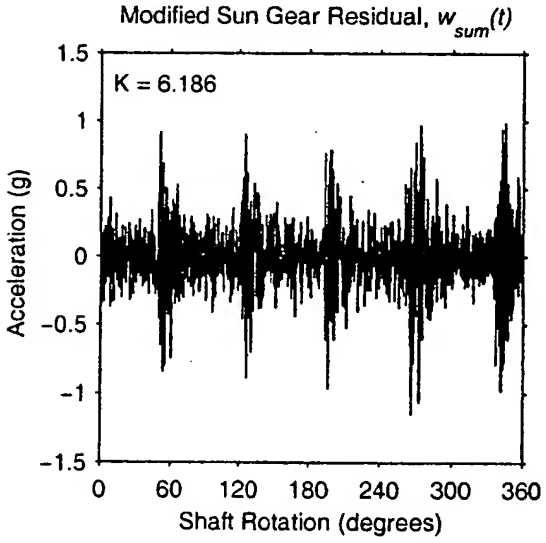


FIG. 4.16F

Sun gear averages, 425 lb ft torque, starboard ring accelerometer.

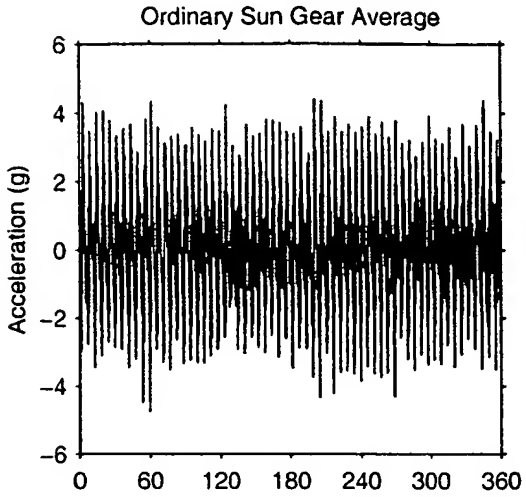


FIG. 4.17a

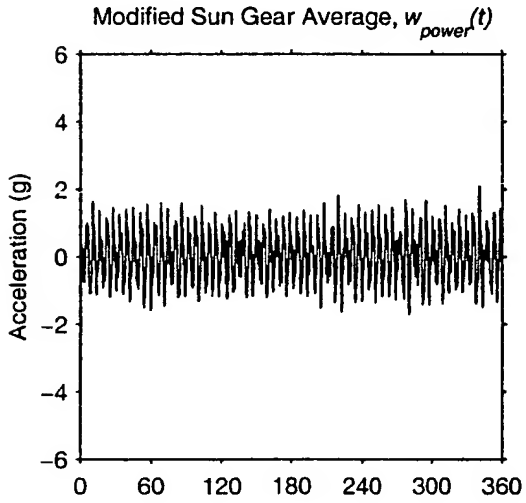


FIG. 4.17b

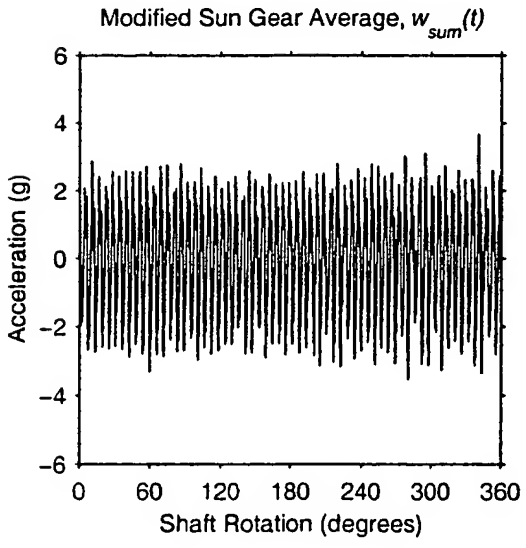


FIG. 4.17c

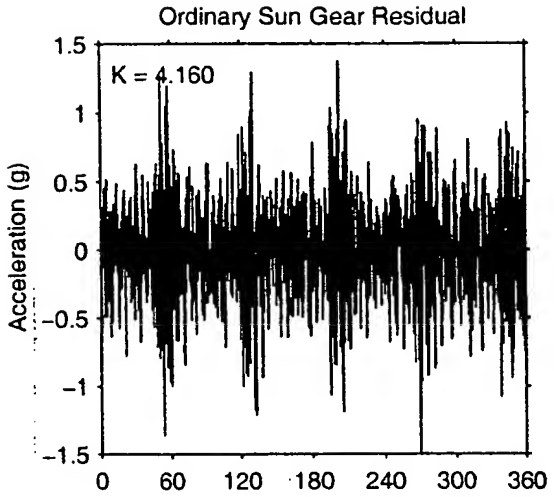


FIG. 4.17d

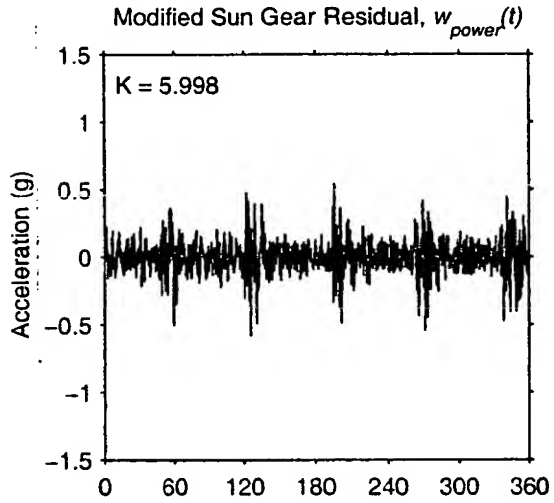


FIG 4.17e

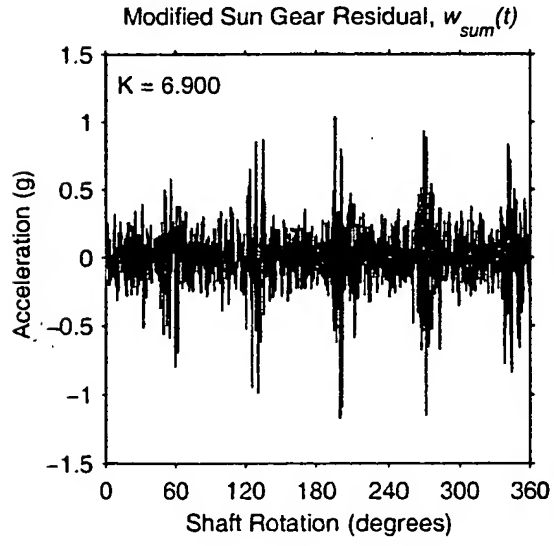


FIG. 4.17f

Sun gear averages. 350 lb ft torque. port ring accelerometer.

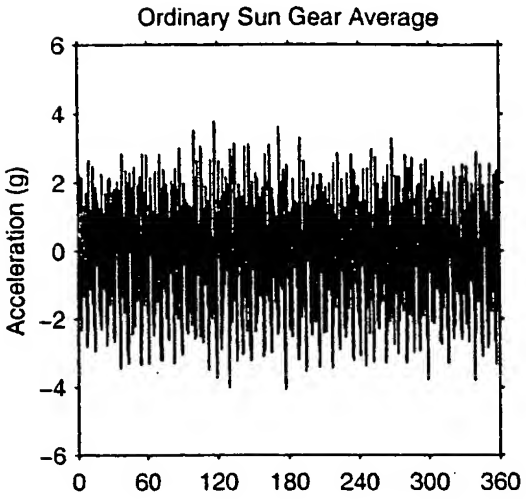


FIG. 4.18a

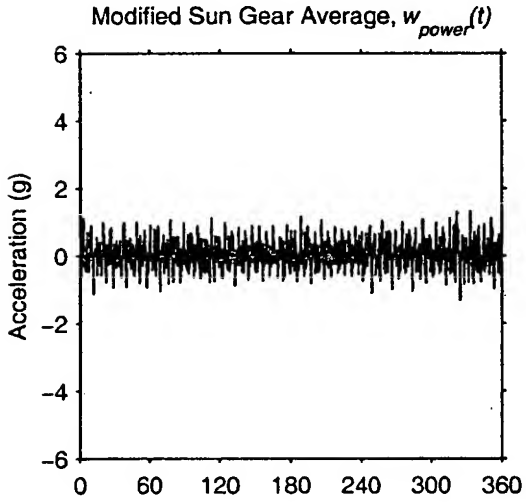


FIG. 4.18b

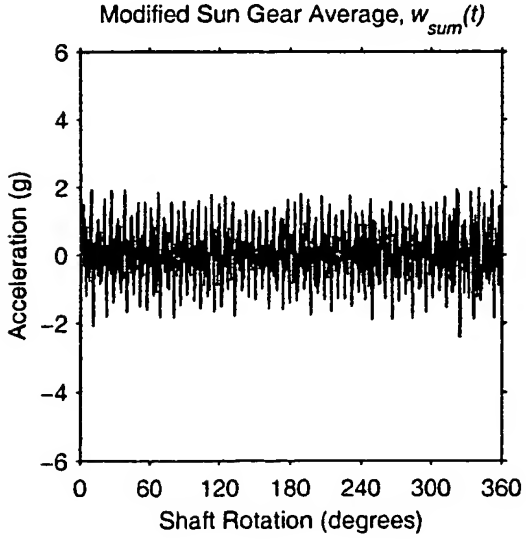


FIG. 4.18c

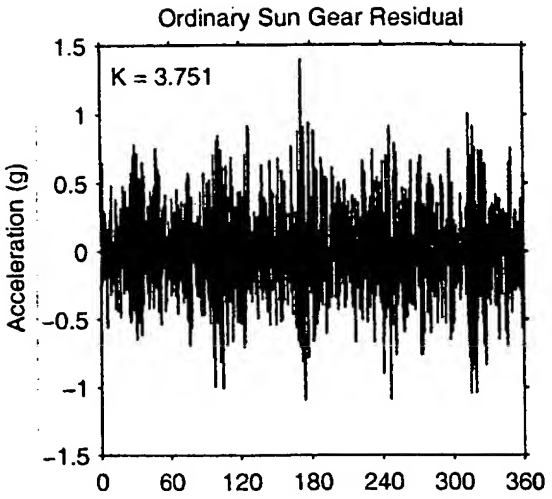


FIG. 4.18d

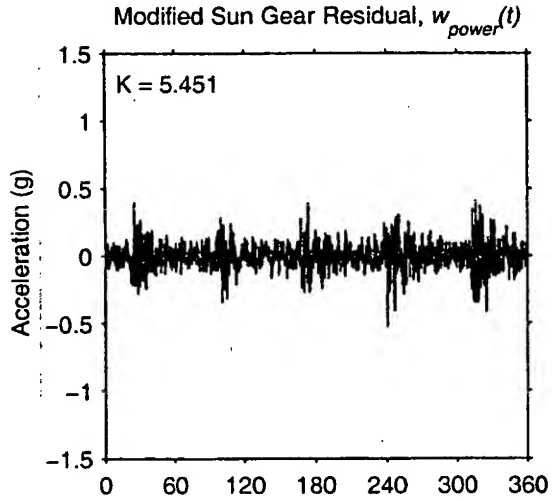


FIG. 4.18e

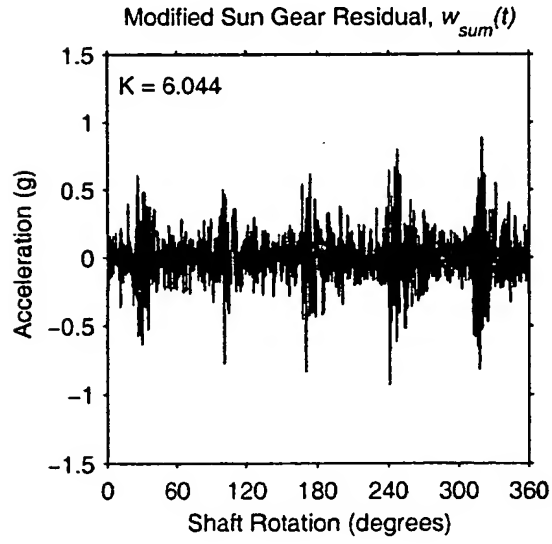


FIG. 4.18f

Sun gear averages, 350 lb ft torque, starboard ring accelerometer.

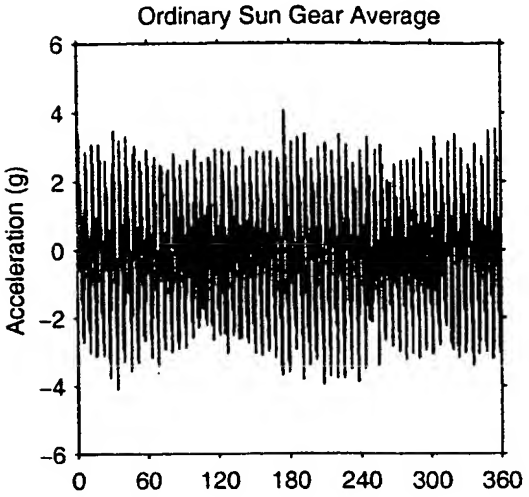


FIG. 4.19a

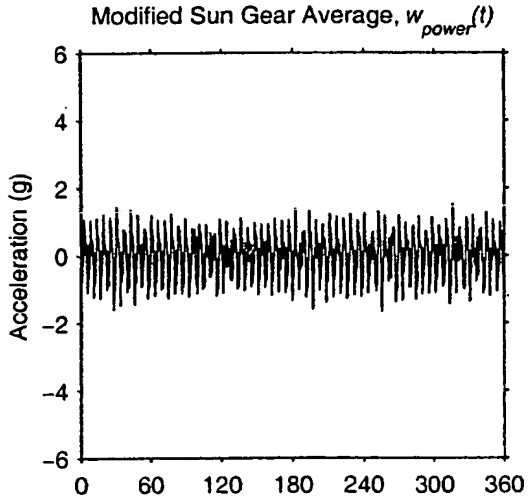


FIG. 4.19b

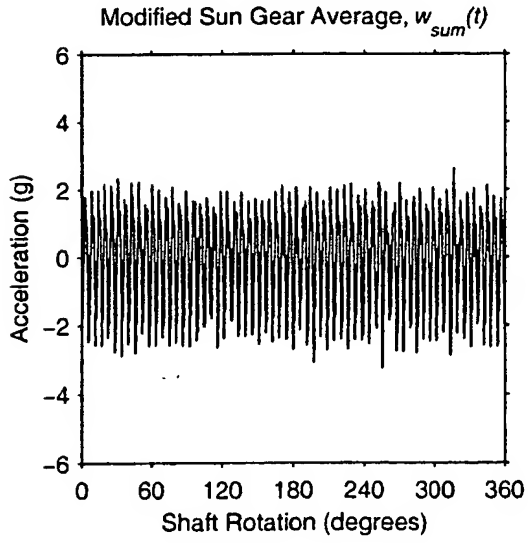


FIG. 4.19c

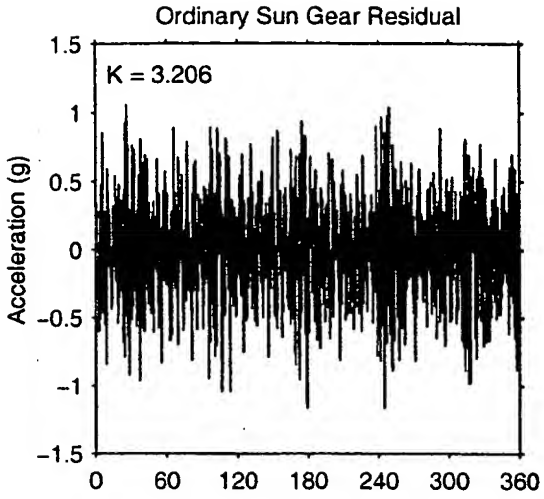


FIG. 4.19d

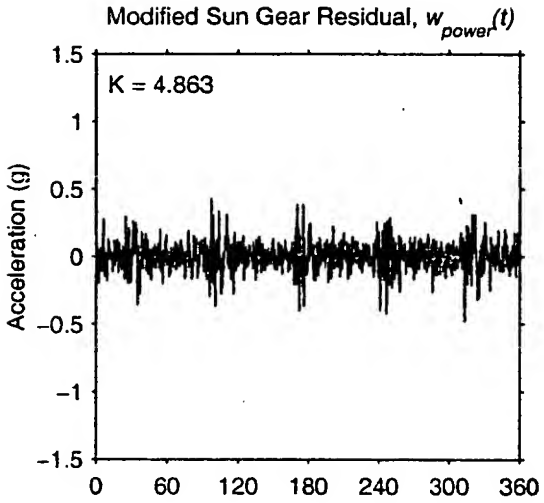


FIG. 4.19e

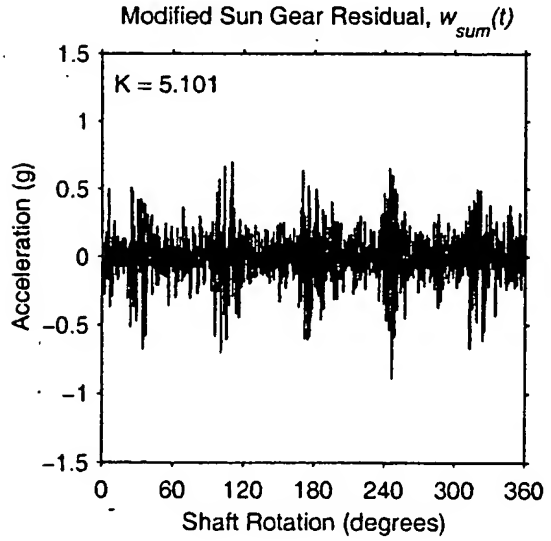


FIG. 4.19f

Sun gear averages, 300 lb ft torque, port ring accelerometer.

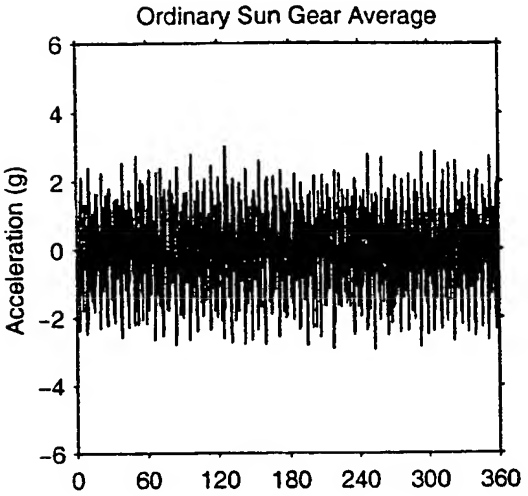


FIG. 4.20a

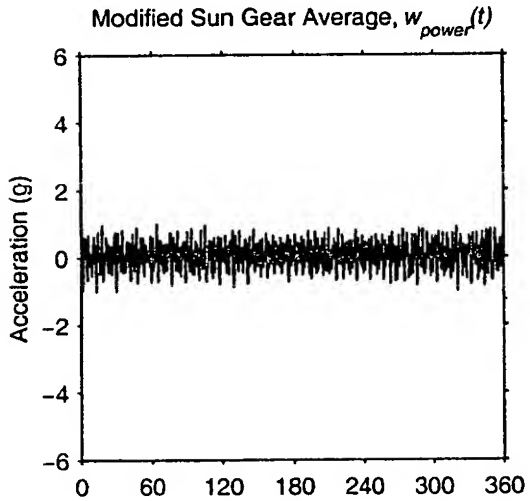


FIG. 4.20b

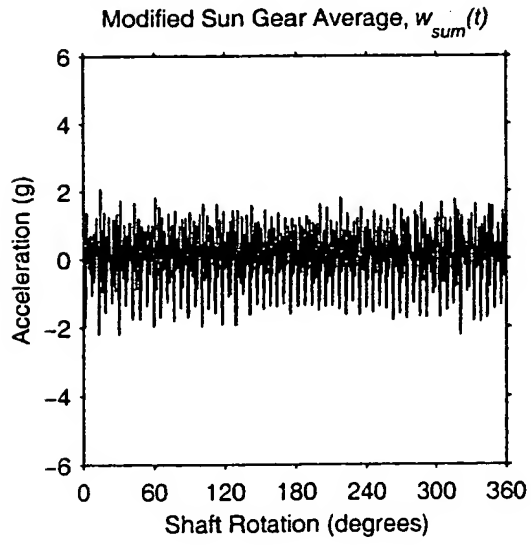


FIG. 4.20c

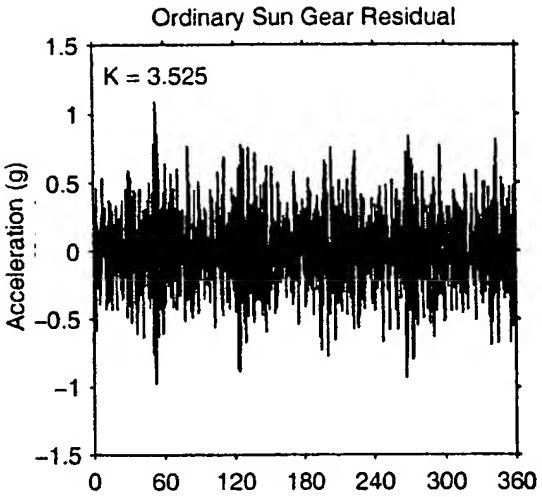


FIG. 4.20d

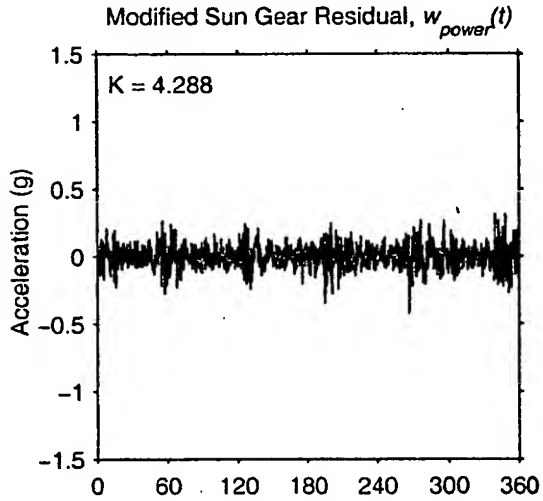


FIG. 4.20e

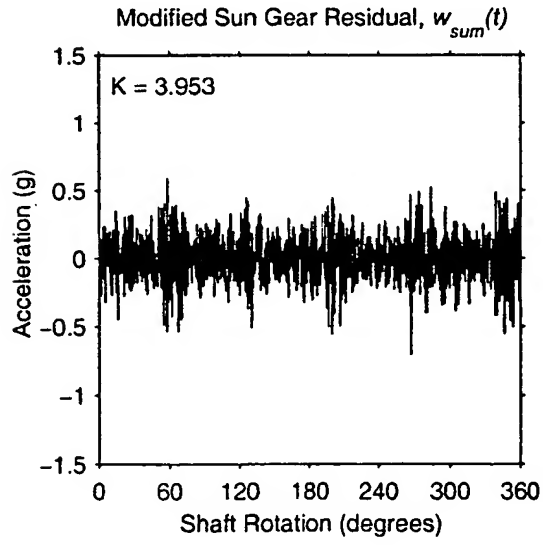


FIG. 4.20f

Sun gear averages, 300 lb ft torque, starboard ring accelerometer.

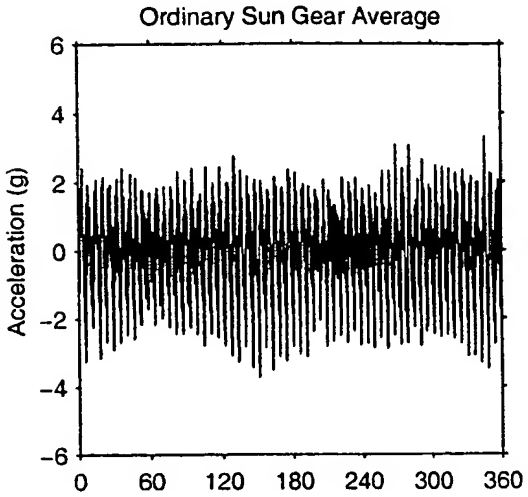


FIG. 4.21a

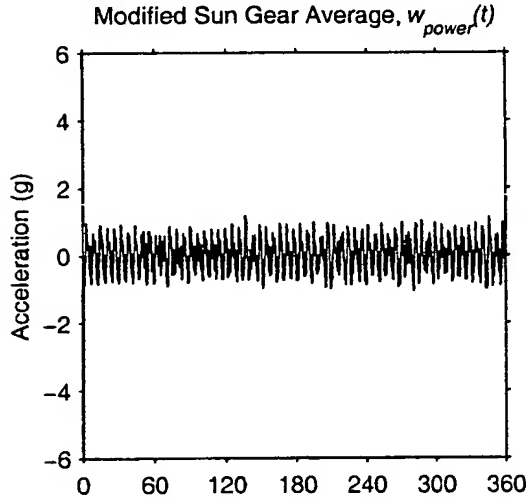


FIG. 4.21b

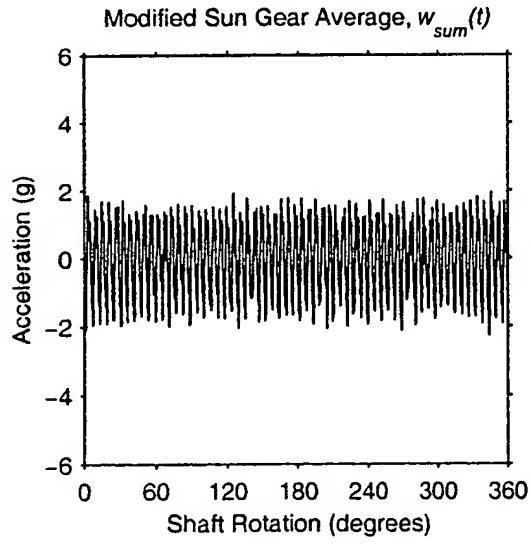


FIG. 4.21c

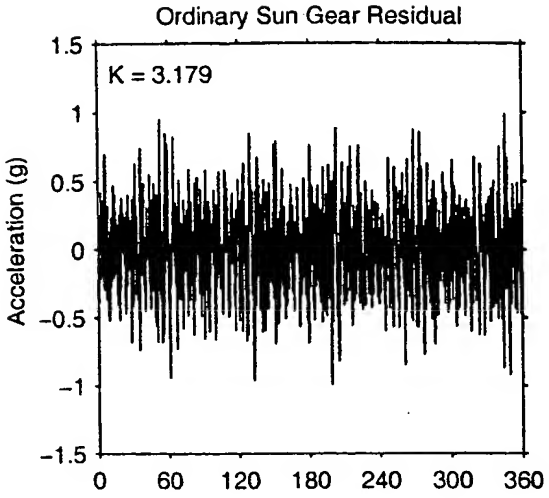


FIG. 4.21d

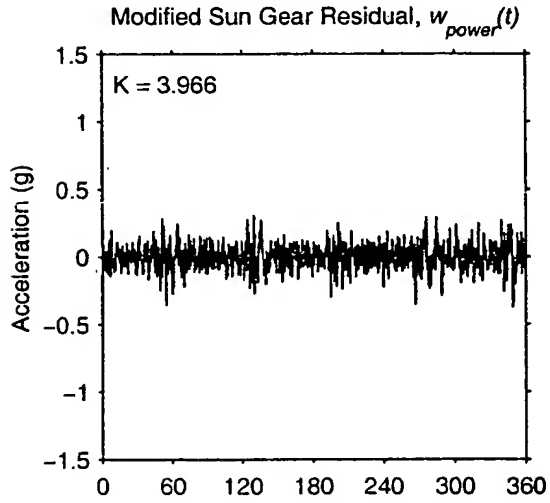


FIG. 4.21e

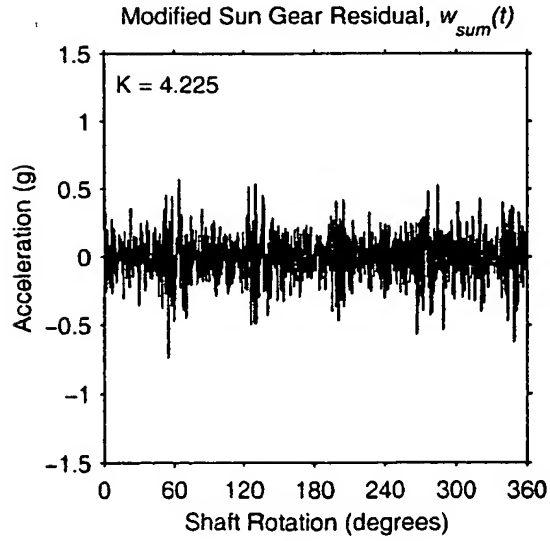


FIG. 4.21f

Sun gear averages, 250 lb ft torque, port ring accelerometer.

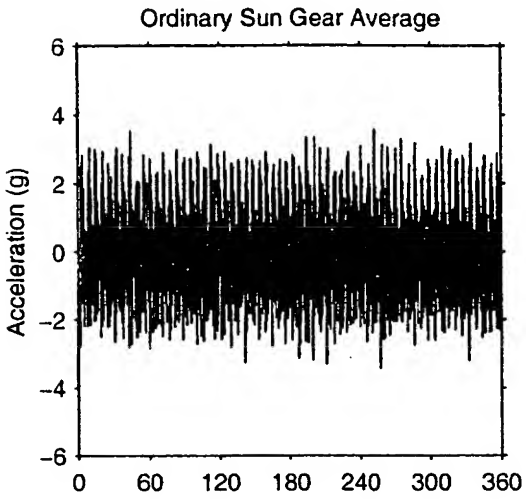


FIG. 4.22a

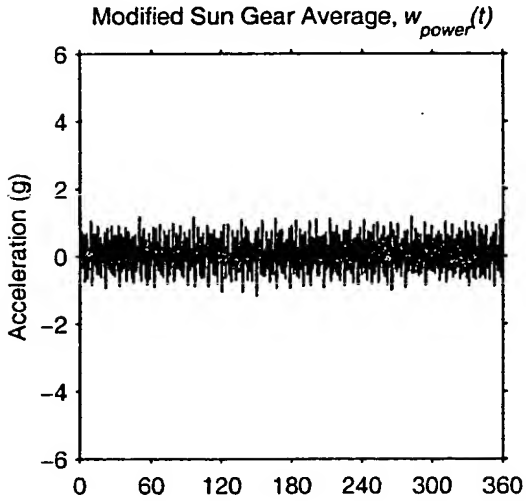


FIG. 4.22b

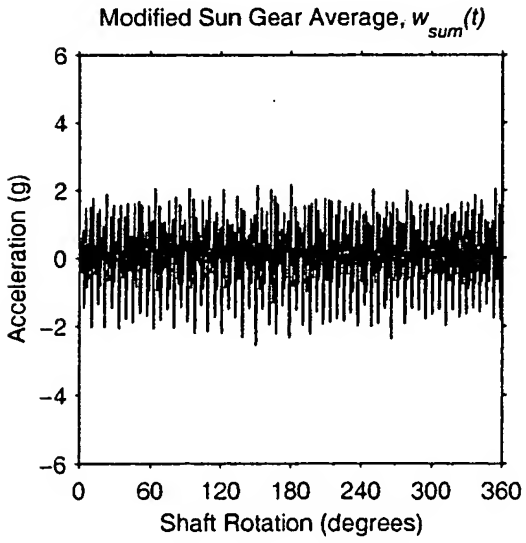


FIG. 4.22c

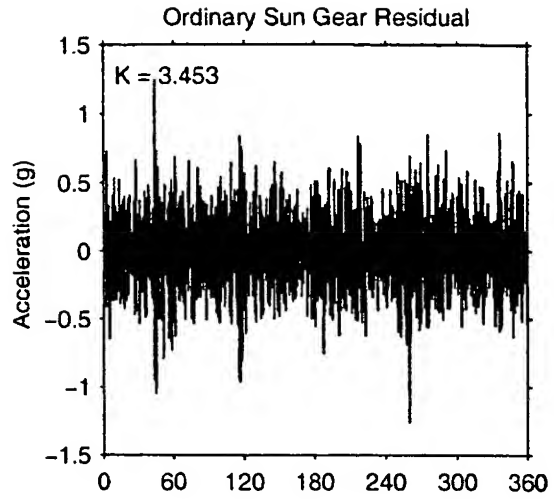


FIG. 4.22d

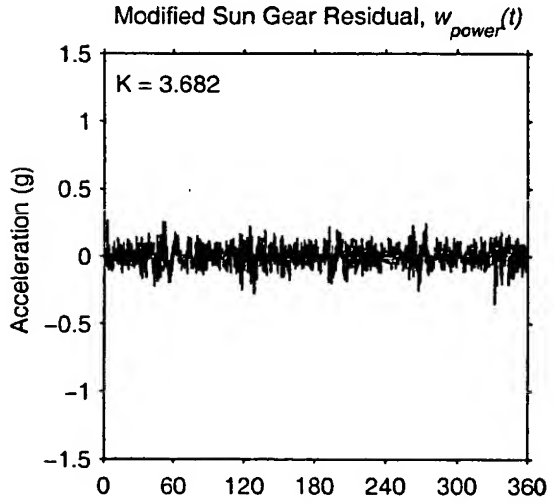


FIG. 4.22e

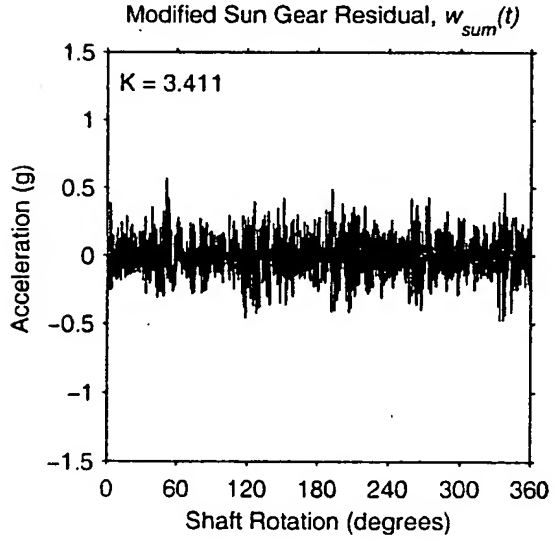


FIG. 4.22f

Sun gear averages, 250 lb ft torque, starboard ring accelerometer.

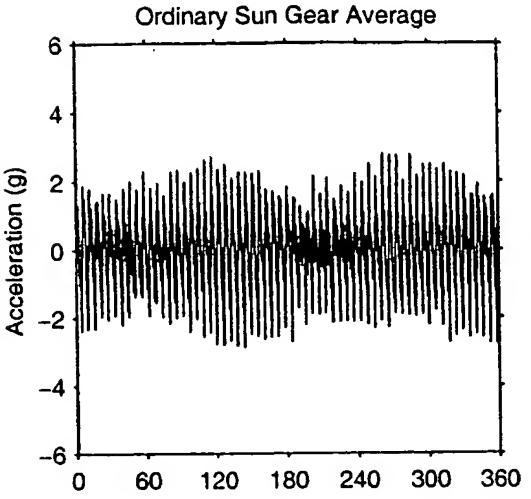


FIG. 4.23a

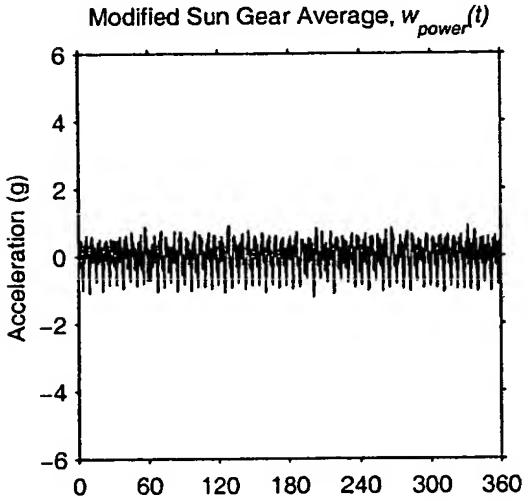


FIG. 4.23b

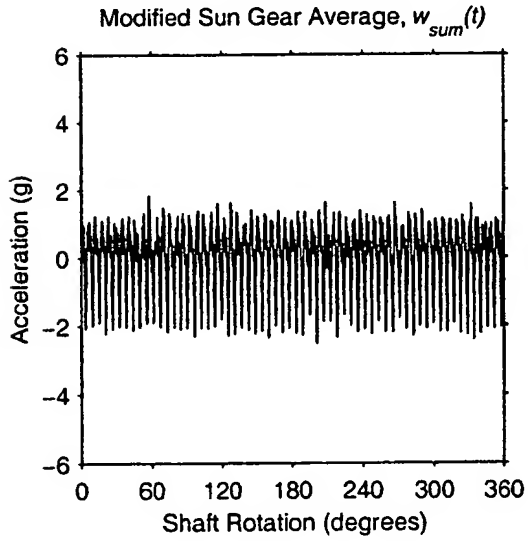


FIG. 4.23c

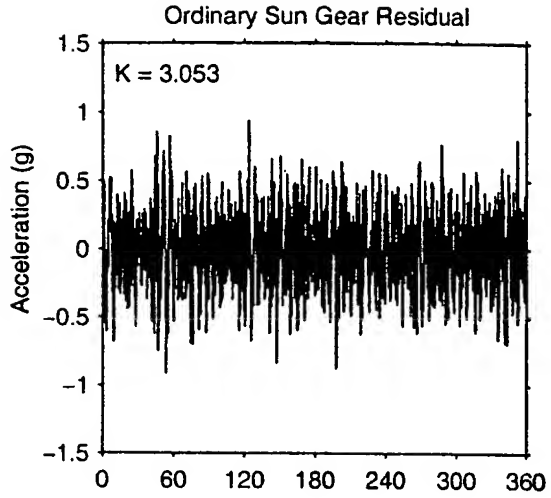


FIG. 4.23d

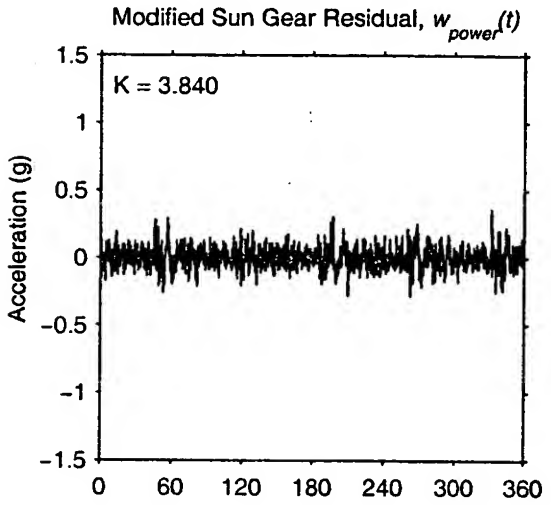


FIG. 4.23e

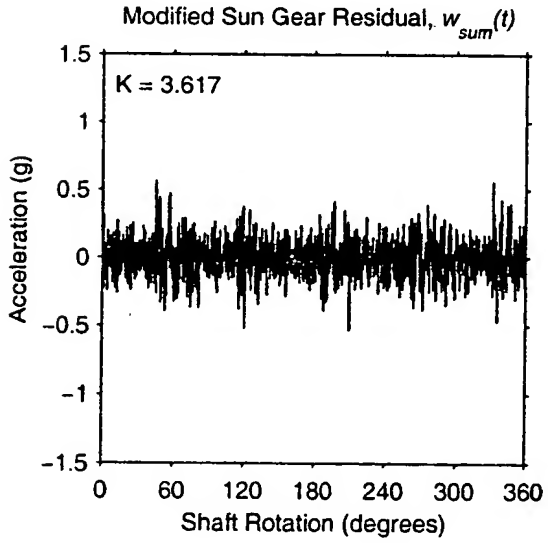


FIG. 4.23f

Sun gear averages, 200 lb ft torque, port ring accelerometer.

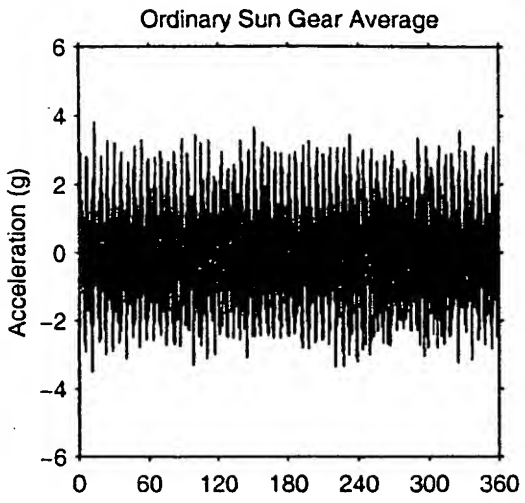


FIG. 4.24a

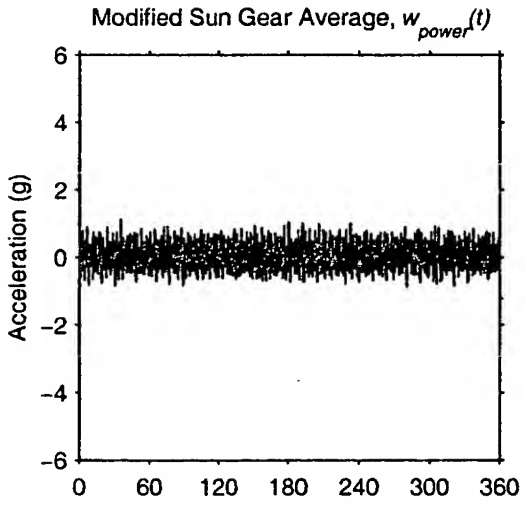


FIG. 4.24b

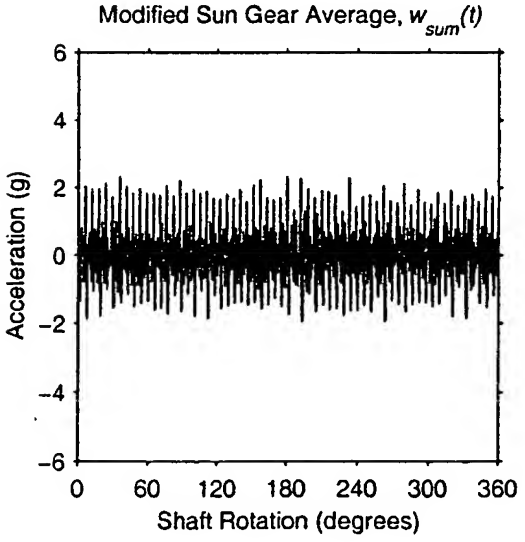


FIG. 4.24c

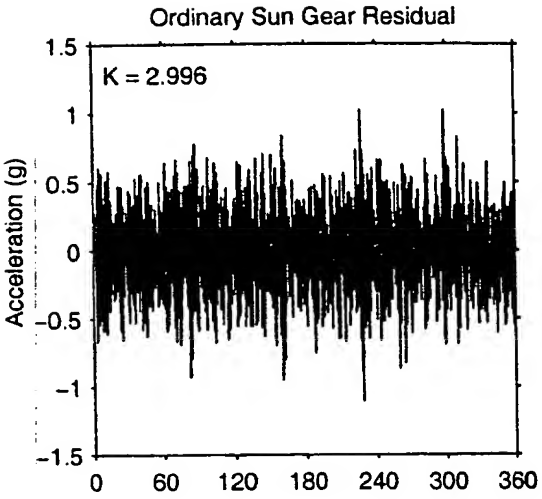


FIG. 4.24d

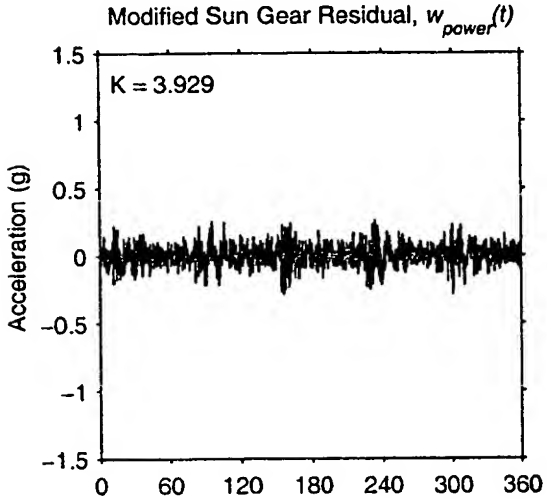


FIG. 4.24e

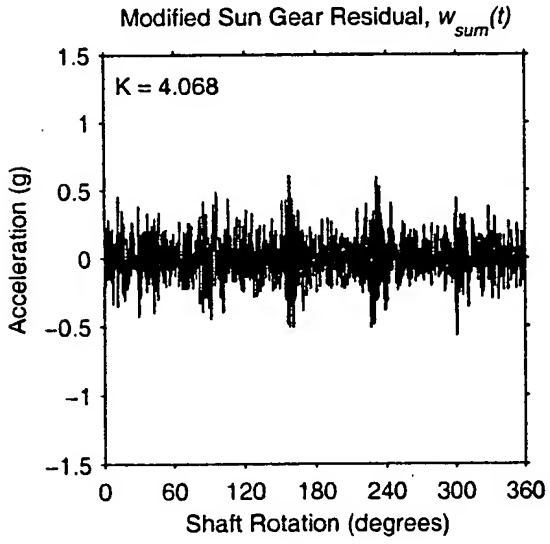


FIG. 4.24f

Sun gear averages, 200 lb ft torque, starboard ring accelerometer.

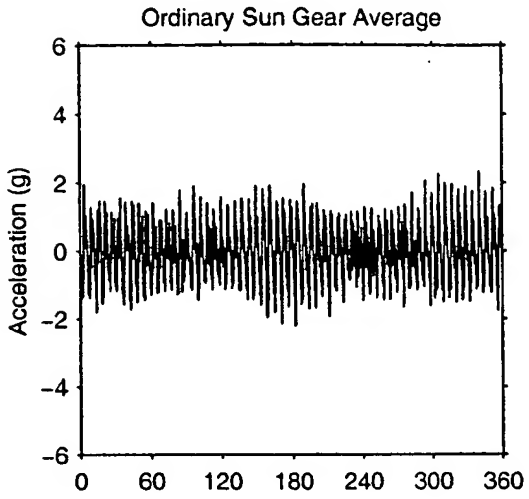


FIG. 4.25a

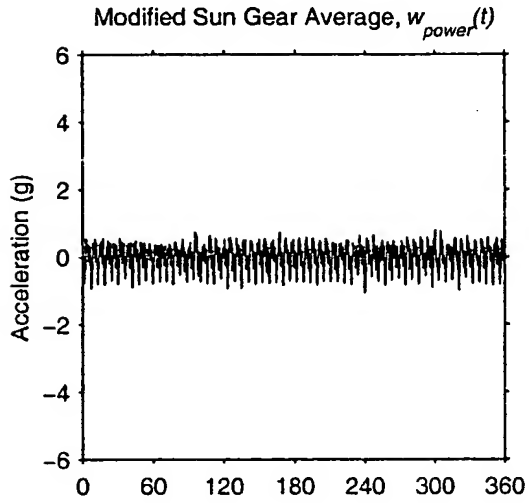


FIG. 4.25b

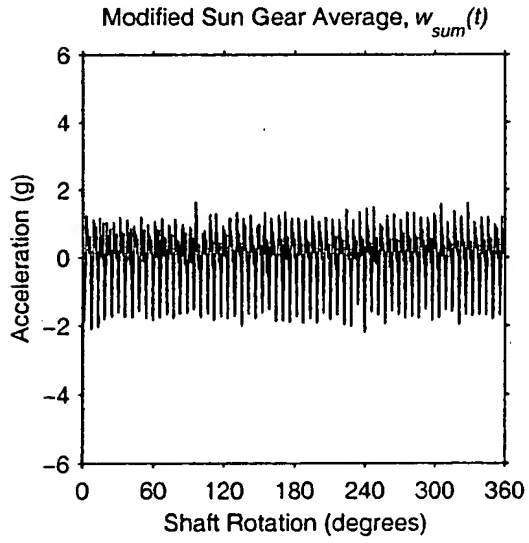


FIG. 4.25c

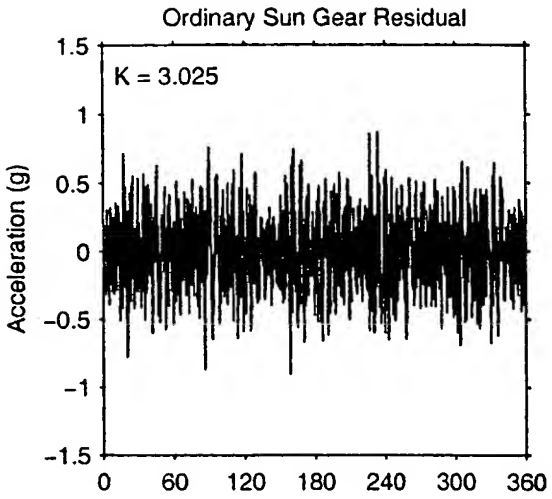


FIG. 4.25d

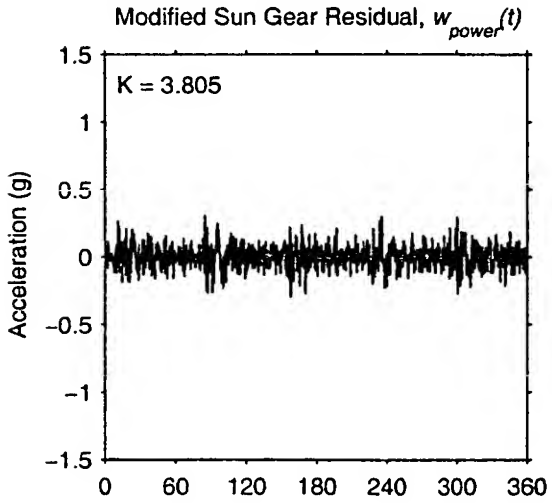


FIG. 4.25e

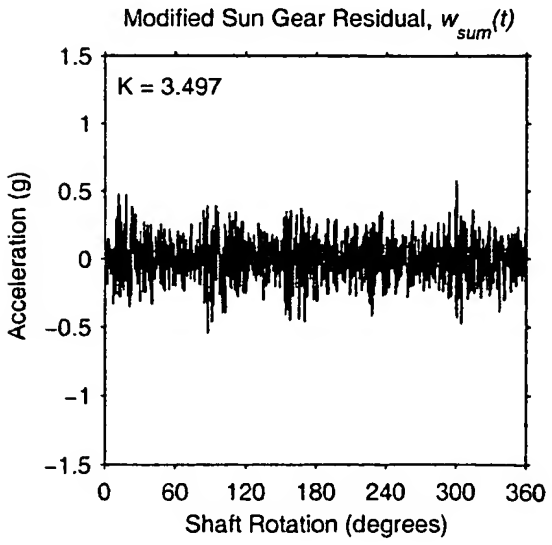


FIG. 4.25f

Sun gear averages, 165 lb ft torque, port ring accelerometer.

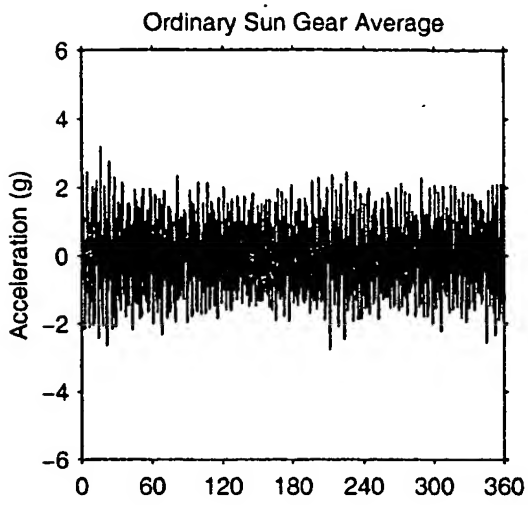


FIG. 4.26a

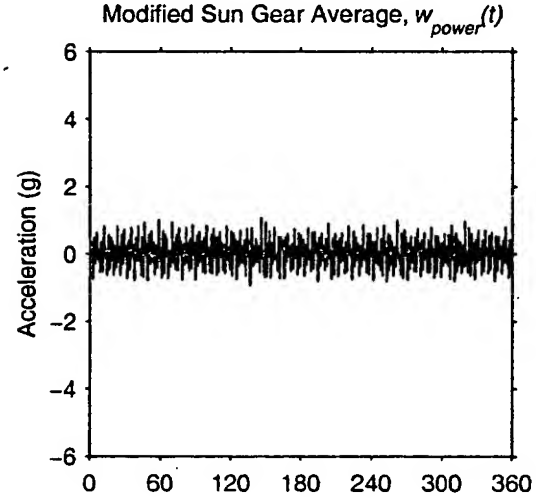


FIG. 4.26b

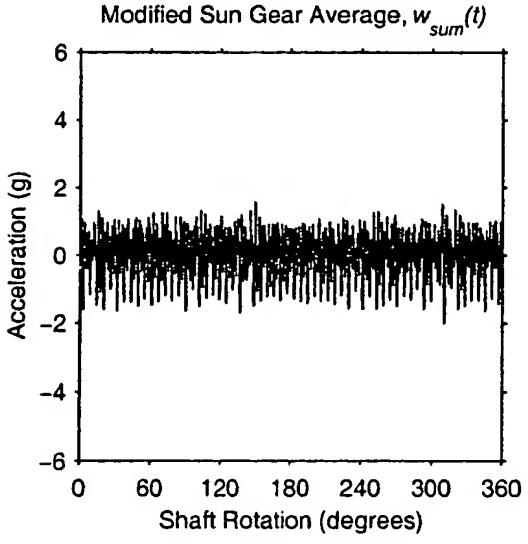


FIG. 4.26c

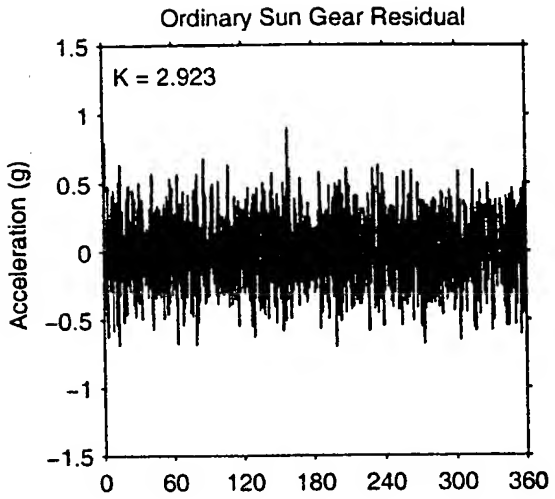


FIG. 4.26d

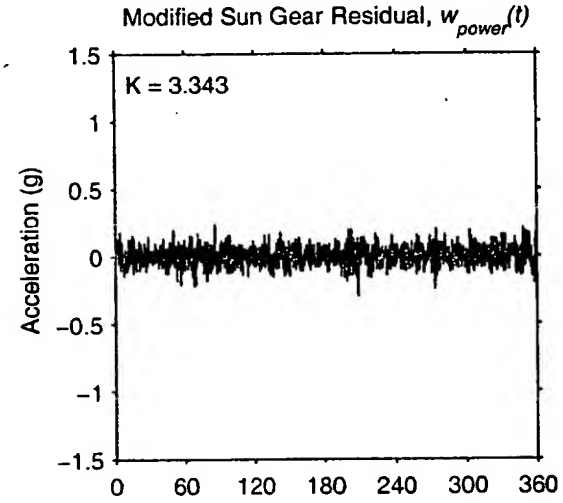


FIG. 4.26e

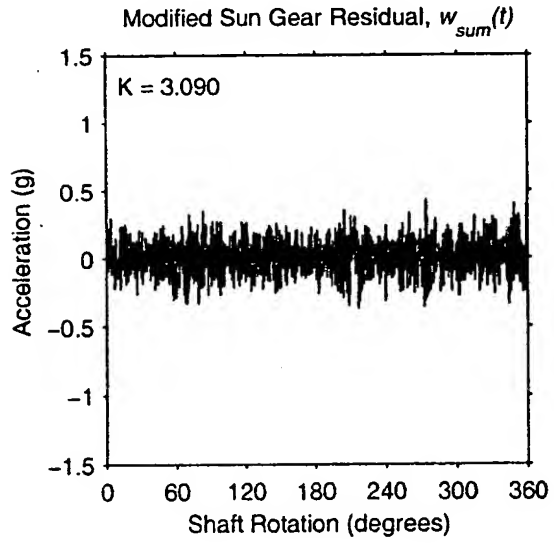


FIG. 4.26f

Sun gear averages, 165 lb ft torque, starboard ring accelerometer.

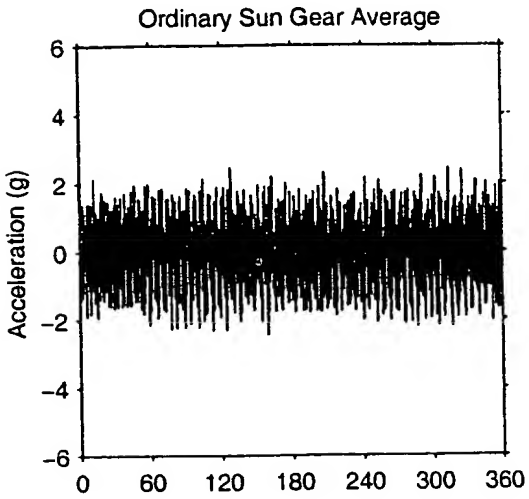


FIG. 4.27a

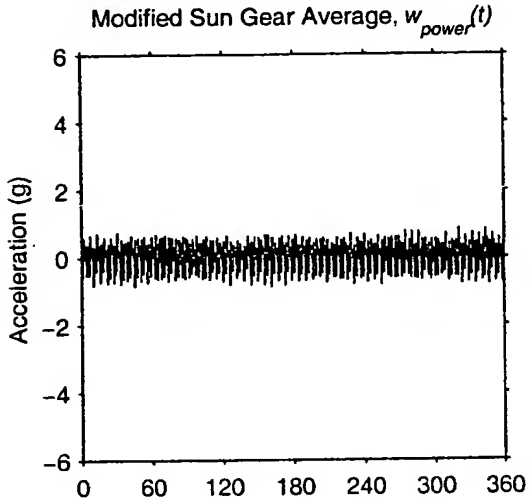


FIG. 4.27b

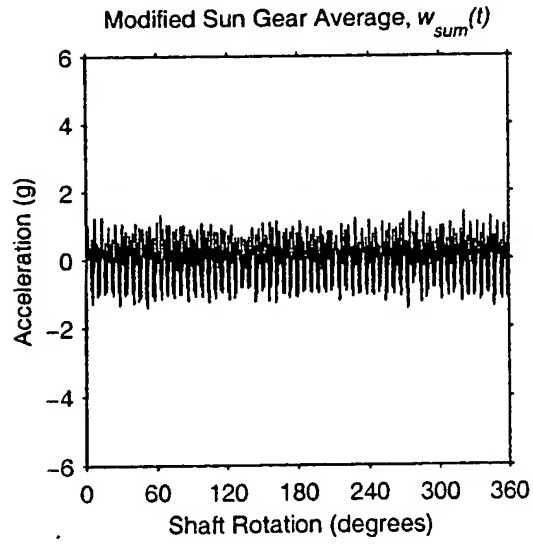


FIG. 4.27c

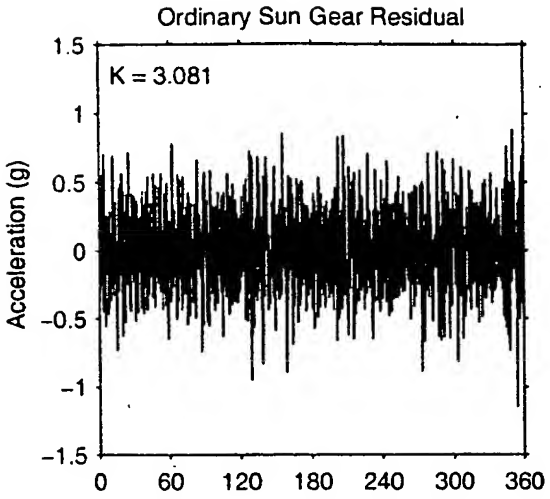


FIG. 4.27d

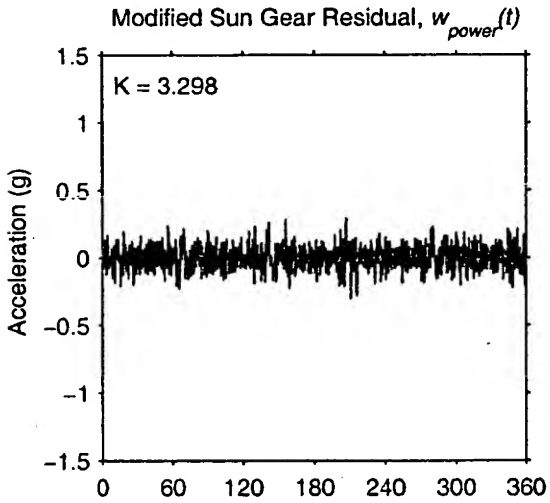


FIG. 4.27e

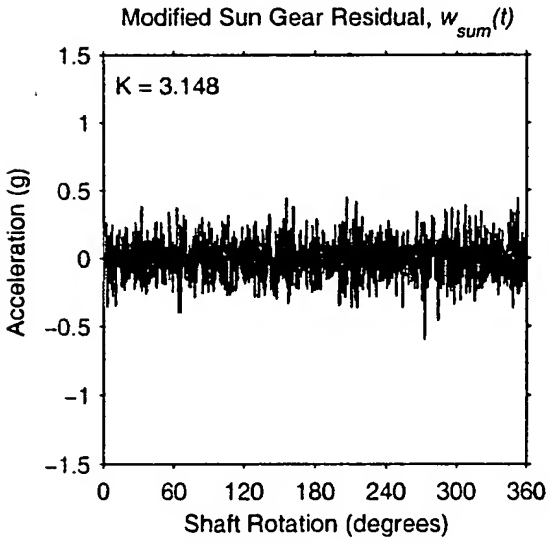


FIG. 4.27f

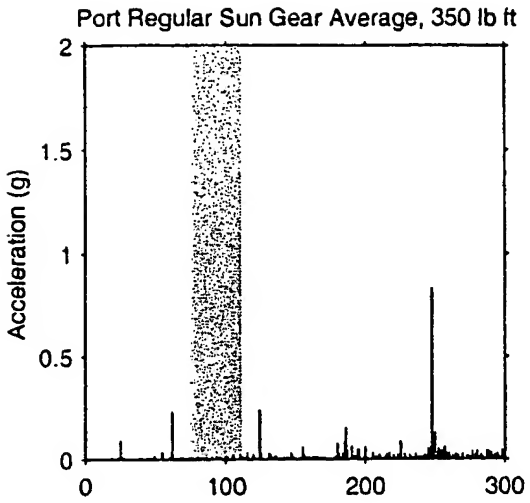


FIG. 4.28a

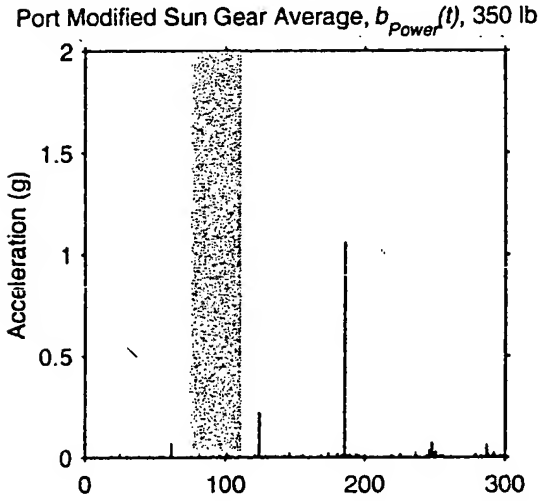


FIG. 4.28b

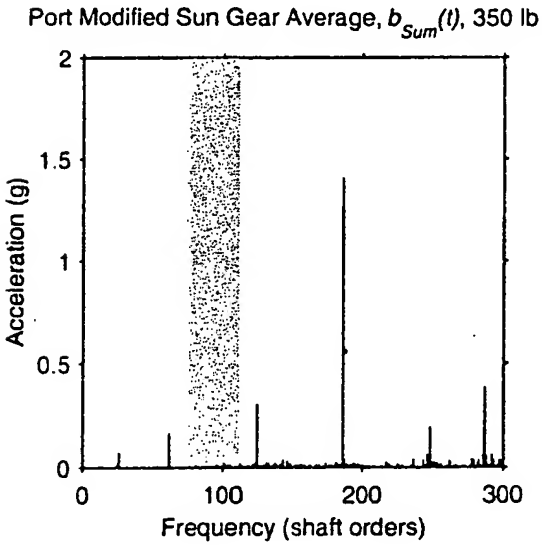


FIG. 4.28c

Spectra of sun gear averages at 350 lb ft from a gearbox without a sun gear fault.

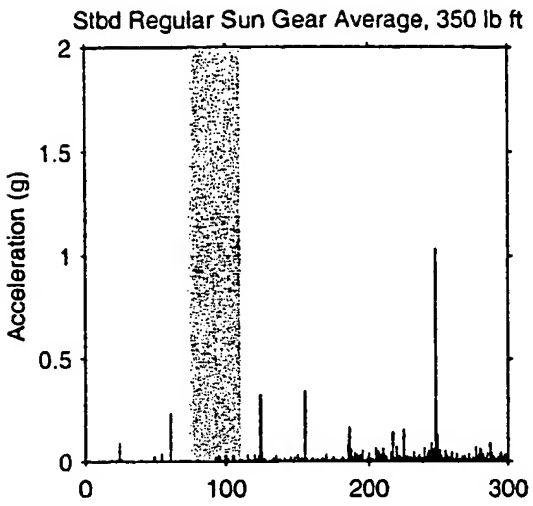


FIG. 4.28d

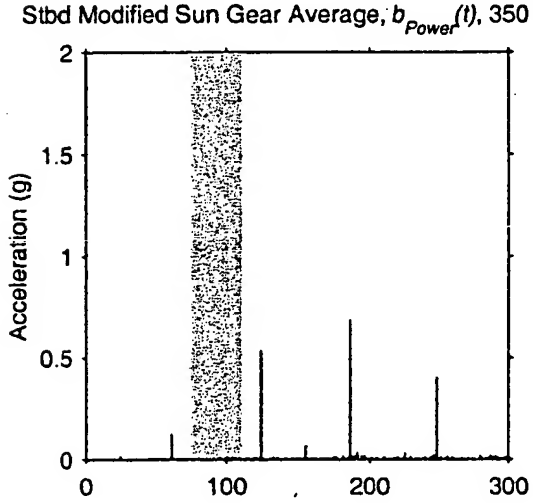


FIG. 4.28e

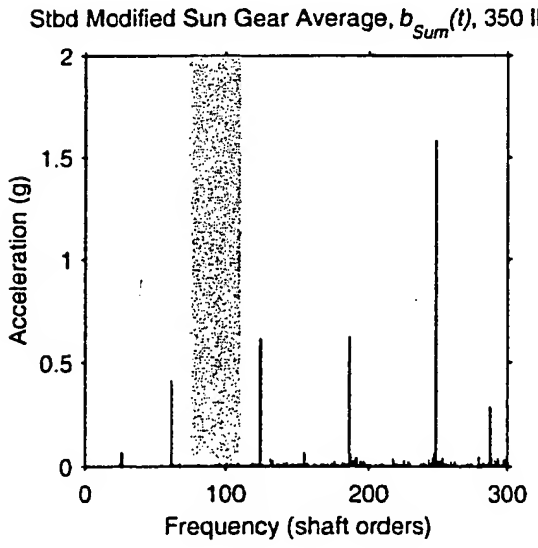


FIG. 4.28f